

Commercializing the Dolby System

Case history of the successful licensing of the Dolby Noise Reduction System; royalty terms described

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This paper will attempt to document some of the events of the early days of licensing the Dolby B-type noise reduction system that culminated in the almost universal incorporation of the noise reduction system itself in consumer cassette recorders and similar audio products, and the marking of these products with Dolby trademarks.

There have been many cases in which inventors of truly novel ideas have never been fully rewarded in terms of fame or fortune for their innovations. This can be because the technology required to realize the invention practically has yet to be invented, or because the invention is irrelevant to any market that exists during the lifetime of the patent. There have been other cases in which the inventors of relevant and timely inventions have failed to exploit their inventions and have left it to others to make money from their ideas. Ray Dolby's inventions are practical, have been made at a time at which there is a market demand for them, and he has had the determination and courage to fight off those who sought to deny him his due rewards.

Ray Milton Dolby was born in Portland, Oregon, in 1933. He grew up in the San Francisco Bay Area. He began working for Ampex Corporation, one of the earliest manufacturers of magnetic tape recorders in the U.S., when he was 16. He later was responsible for developing a major part of the electronics of the world's first practical video tape recorder.

After graduating from Stanford University in 1957, he attended Cambridge University in England, where he worked on long-wavelength X-rays and received a Ph.D. in 1961. In 1963, he took up a two year appointment as a United Nations advisor in India.

Amateur

Dolby had for many years been a keen amateur recording engineer and was aware of the degradation of recording quality caused by the noise inherent in the process of recording audio (or video) signals on magnetic tape. It was while he was in India that he

began to think seriously of ways to reduce this noise without causing other degradations in the quality of the recording. This thought process resulted in the ideas that formed the basis of the Dolby A-type, B-type and C-type noise reduction systems, various Dolby video noise reduction systems that have never been exploited commercially, and a wealth of alternative and innovative ways of realizing these systems practically.

Returning to England in 1965, Dolby set up his own laboratory in London to investigate and explore his ideas relating to noise reduction and other topics. The company was called "Dolby Laboratories" and was incorporated in 1968. Although the company had its center of gravity in England for its first 10 years, it has always been an American company. Until the center of gravity moved to San Francisco in 1976, its corporate headquarters were in New York.

In 1965, a working unit of the Dolby A-type (A for audio) noise reduction system was produced. This system was designed to deal with a wide variety of audio noise reduction applications, especially with the noise problems of the tape recorders used in recording studios to record the master tapes from which phonograph records are cut.

Up to 1966, several noise reduction systems for this purpose had been demonstrated to the recording industry. None was capable of reducing noise without degrading the recording in some way. Dolby was therefore faced with considerable skepticism when he tried to sell his new invention to the recording industry, as his potential customers had no reason to believe that his system would work any better than the others.

There was a need for noise reduction in the recording industry. People were beginning to realize that what was generally thought of as "surface noise" on vinyl L.P.s did not in fact come from the surface of the record itself but was the noise of the master tape from which the record was cut. Reducing the noise of the master tape would therefore reduce the "surface noise" of a record made from the tape.

Also people had started to record using multitrack tape recorders, using at first 4, then 8, 16 and 24-tracks. When a multitrack tape is mixed down, the noise level on the resulting two-track master can be considerably higher than if the recording had been made directly onto two tracks.

Trial

In January 1966, Decca records in England concluded that Dolby A-type noise reduction did what Dolby

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said it did, and ordered nine Dolby A 301 A-type noise reduction units, the first of which was used in Vienna in May 1966 to record some Mozart piano concertos played by Vladimir Ashkenazy. In November that year, Decca released the first record that had been mastered using Dolby A-type noise reduction, Mahler's Second Symphony conducted by Sir Georg Solti.

Word spread that Dolby's noise reduction system actually worked, and the record industry gradually started to use it, first of all only on classical recordings and then, as multitrack recording spread, on more and more different types of recording. Early records mastered using Dolby A-type were often identified as such, and the improvements in sound quality brought about by the use of A-type noise reduction was commented on favorably in reviews of these records in newspapers and magazines throughout the world. The record-buying public became aware of the name "Dolby" in connection with better-sounding records.

Dolby was urged to develop a noise reduction system for consumer-quality tape recorders. A-type noise reduction gave spectacular results when applied to consumer recorders, but was far too expensive to be used for this purpose. However, since the predominant noise of a consumer tape recorder is high-frequency noise, a significant noise reduction effect can be attained by reducing this noise only, and the sliding-band noise reduction system, another of Dolby's inventions, does this very effectively with a much simpler circuit than that required in Dolby A-type to give noise reduction across the complete frequency spectrum.

Practical development of what was initially called "The Simplified Dolby System," and some time later became called Dolby B-type noise reduction, began in April 1967. The K.L.H. Research and Development Corporation in Cambridge, Massachusetts, which was developing a consumer-quality tape recorder and wanted to give it a major performance advantage by using noise reduction, successfully persuaded Dolby to begin this project. An agreement in principle to license K.L.H. to build B-type circuits into its tape recorders was signed in May 1967.

License Agreement

Concurrent with K.L.H.'s work on the tape recorder itself and Dolby's work on the practical implementation of his "simplified system," a license agreement was developed. The initial draft was prepared by K.L.H. attorney William Humbert of Fish, Richardson and Neave of Boston. Dolby handled most of the negotiations with K.L.H. and, later on, with its then parent company, the Singer Corporation. He also wrote most of the resulting wording changes himself, which probably accounts for the practical nature of the agreement that resulted; however, Dolby received considerable help from his attorney, Robert F. O'Connell, of the then Cooch & O'Connell of Boston, Massachusetts.

At the time the agreement was negotiated, the word "Dolby" was becoming known by the public but it had not been widely registered as a trademark. Nevertheless, rights to use the Dolby name in addition to the "S/N Stretcher" trademark ("S/N" means "Signal to

Noise (Ratio)"), which Dolby used on all A 301 noise reduction units, were included in the license, together with the necessary quality control requirements.

A middle five-figures initial payment and a royalty of 4% of the ex-factory price of each tape recorder sold were agreed upon. Dolby insisted on a fairly substantial initial payment to give him at least some return for developing the Simplified System in the event that K.L.H. decided to stop making tape recorders soon after it started to make them.

A license agreement, giving K.L.H. a right to make tape recorders incorporating Dolby B-type noise reduction, exclusive until November 1969 (later extended to March 1970) and nonexclusive thereafter, was finally signed in April 1968. In addition to the license agreement there was a consultancy agreement covering the provision of technical support for the licensee.

The K.L.H. Model 40 tape recorder was launched in June 1968, to enthusiastic critical acclaim, which reflected well on the product itself and further enhanced the reputation of Dolby noise reduction and public awareness of it. Serious production did not begin until almost the end of the year. The product did not sell well mainly because of production difficulties and acute reliability problems. Dolby's insistence on a large initial payment turned out to be wise precaution: K.L.H. made less than 2,000 units of the tape recorder for which the "Simplified Dolby System" was designed.

Second License

Dolby's second license, signed in February 1970, was for Advent Corporation of Cambridge, Massachusetts, to sell what were called at the time "black boxes." A black box, or add-on unit, is a box containing two or more Dolby B-type noise reduction circuits and the necessary interface circuits to enable B-type noise reduction to be applied to almost any existing tape recorder or cassette recorder. Such products had been proposed in 1967, but Dolby resisted their introduction until his reputation was more firmly established, since the results obtained from an add-on unit depend greatly on the performance quality of the tape recorder with which it is used. However, add-on unit enjoyed considerable popularity in the early 1970s until there was such a wide variety of products with built-in Dolby B-type noise reduction available that there was no longer any need for the consumer to bother using an old tape recorder with an add-on noise reduction unit.

The basic operational inconvenience of the open-reel recorder condemned it to being a relatively small-volume item in the consumer audio market. However, the 8-track cartridge and, more significantly, the Compact Cassette gave the consumer the advantages of magnetic tape recording without the inconvenience. Soon after Philips introduced the Compact Cassette as a dictating machine in 1965, consumer cassette recorders intended for the recording and playback of music and speech were being produced all over the world in large volumes. Most early cassette recorders had fidelity approximating that of A.M. radio, but quality improvements took place relatively quickly, beginning with the introduction of stereo recorders in 1967, and followed by mass duplicated prerecorded

stereo cassettes, which could also be played on monaural machines.

Experiment

Dolby began experimenting in 1968 with B-type noise reduction on both 8-track and the Compact Cassette, although after a relatively short period of time he concentrated exclusively on the latter. By this time, the industry had developed improved cassette mechanisms, heads, tapes and shells, such that with some minor improvements to the electronics, performance that was high fidelity in all aspects but that of noise could be obtained.

Several companies were working on noise reduction systems; many concentrated on playback-only systems, (some of which actually got into production) which tended to cause more problems than they solved. Others, notably J.V.C. and Sony, were developing record/playback systems.

Dolby caused considerable excitement in October 1969 when he demonstrated a compact cassette recorder with external Dolby B-type noise reduction at the Audio Engineering Society Convention in New York and to several U.S. high-fidelity manufacturers. He also travelled to Japan that year and discussed licensing with several companies there.

The first company licensed in Japan was Nakamichi Research, Inc., with whom licensing discussions were started in November 1969. Nakamichi specialized at that time almost exclusively in O.E.M. business and was ideally placed to exploit the demand for high-fidelity cassette recorders from the U.S. and from Europe. It was already making advanced cassette recorders and a product with Dolby B-type noise reduction, an open-reel recorder for K.L.H., the Model 41.

Dolby took advantage of the hiatus caused by K.L.H.'s period of exclusivity to think about his licensing program and to consult with licensing experts around the world, getting their opinions as to the best way to develop the basic form of the K.L.H. license into a worldwide general-use license. This process was completed in time for a new agreement to be developed for licensing Advent and Nakamichi.

In the second generation agreement, the initial payment was reduced to \$5,000, but separate agreements were required for tape recorders, amplifiers and receivers, and add-on noise reduction units. The royalty rate was 2% for tape recorders, amplifiers and receivers, and 4% for add-on units. The agreements, which also included rights to the trademarks "Dolby" and the "Double-D" symbol (first used by Dolby Laboratories in 1969), were still in the form of a license agreement and a consultancy agreement.

Acclaim

Nakamichi's license agreement became effective in July 1970. In the summer of 1970, Nakamichi-made high-fidelity cassette recorders with Dolby B-type noise reduction were introduced on the U.S. market by Advent, Fisher and Harman Kardon. They were again critically acclaimed. These days we take the performance of cassette recorders for granted. It sometimes is hard to imagine the impact that the true high-

fidelity performance of these products made on those that were hearing them for the first time.

In the rest of 1970, four new licensees signed the second-generation license agreement. Apart from Hitachi, these were all audio specialist companies. Also in 1970, Dolby employed a Japanese company, Continental Far East, Inc., to act as Tokyo liaison office to help deal with its licensees in Japan and the considerable number of companies that expressed interest in becoming licensees, a service that C.F.E. still performs.

In 1970, Dolby discussed the idea of recording prerecorded cassettes with the Dolby B-type characteristic (so that they would have a low noise when played on players equipped with Dolby B-type noise reduction) with several record companies. Technically, it was easy enough to do, Dolby designed and started to manufacture a professional-standard Dolby B-type encoder for this purpose. The record companies did not want to issue cassettes in both normal and Dolby encoded forms, so before they would issue Dolby encoded cassettes, they had to assure themselves that the encoded cassette would sound acceptable when played on a player without Dolby noise reduction.

Listening tests performed by several record companies, notably Decca in the U.K. and Ampex Stereo Tapes in the U.S., showed that the encoded tapes were even preferred over non-encoded tapes when played on players without noise reduction. Later that year the companies issued their first batch of B-type encoded tapes at a time when less than 40,000 cassette players capable of decoding them existed in the world.

Dolby developed a trademark and quality-control license for record companies to use the Dolby trademarks on prerecorded tapes. Initially a royalty was contemplated but it was thought that these tapes would help establish Dolby B as the standard consumer tape noise reduction system and would also promote sales of Dolby B-equipped cassette recorders. The license was therefore made royalty-free.

The summer 1971 Consumer Electronics Show, which was the first summer C.E.S. at which genuine mass production cassette recorders with Dolby noise reduction were shown by licensees and their O.E.M. customers, saw three more events that helped establish Dolby B-type's acceptance as the main consumer tape noise-reduction system. The first event was a demonstration to the press and licensees by Dolby Laboratories in cooperation with radio station WFMT, Chicago, of the use of Dolby B-type noise reduction on FM radio.

Although Dolby FM is no longer significant, it played an important role in furthering the acceptance of Dolby B-type noise reduction in the early 1970s. In those days, tape products were regarded by many in the audio industry as being of secondary importance since their sales were small compared with those of turntables, receivers and loudspeakers.

While Dolby B was tied to tape, it was glamorous and well respected but it did not generate real excitement as far as potential sales volume was concerned. With the FM application, this reservation was dispelled, since there was the prospect of being able to sell Dolby noise reduction in every FM tuner and receiver.

The second event at the 1971 Summer C.E.S. was the joint announcement by Dolby Laboratories and Signetics Corporation that they had agreed to cooperate in the development of a special integrated circuit for use in the Dolby B-type circuit. As there is no point in designing special integrated circuits unless there is the prospect of selling them in the hundreds of thousands, this announcement further directed people's attention to the mass market potential of Dolby noise reduction.

An integrated circuit would simplify the circuitry required to realize the Dolby B-type circuit, widening the range of products in which it could be used and thus considerably increasing the size of the potential market. The prospective availability of an integrated circuit stimulated interest from many desirable potential licensees especially in Europe, where the complexity of the discrete Dolby B-type circuit was considered by several companies to be inappropriate for consumer products.

The third event of the C.E.S. was the announcement by Dolby Laboratories of simplified licensing arrangements and a new, lower-cost royalty structure for its license. There was now to be a single license agreement granting patent, trademark and know-how rights and covering all consumer audio product categories, so multiple initial payments were no longer called for. Instead of a fixed percentage of the product selling price, always a tricky thing to define, the new royalty structure was based on the number of Dolby B-type circuits sold per calendar quarter, the first 10,000 being at 50 cents each, the next 40,000 being at 25 cents, and all above 50,000 being at 10 cents each. These basic royalty rates are tied to the U.S. Consumer Cost of Living Index, which this year (1983) multiplies these rates by 2.406. The new rates were intended to indicate to large potential licensees that were still sitting on the fence, the potential mass-market application of Dolby noise reduction.

In the middle of 1971, Dolby Laboratories set up a formal quality control program for its licensees' products. Prior to this, quality control had been performed on an *ad hoc* basis, since there was a basic consensus of understanding between Dolby and its licensees as to what were appropriate performance parameters for licensed products. The need for more formal quality standards and a process to enforce them became obvious as more companies catering for the middle and even the low end of the market were licensed. The quality control program has been successful in preventing products with substandard performance from reaching the market, thereby maintaining the quality image of products marked with the Dolby trademarks.

The events of 1971 turned out to be effective in communicating Dolby's message to the consumer audio equipment manufacturers and tape duplicators. In 1971, nine companies signed license agreements, including the company that has now the largest production rate of products with Dolby noise reduction and the company that often has the second largest production rate. In 1972, the number of licenses signed was 12 and in 1973 the number was 13. The companies that currently have the 10 highest production rates had all signed by the end of 1973.

Throughout his negotiations with the various

consumer electronics companies, Dolby stuck to his objective of getting them to adopt his standard noise reduction system under his standard licensing terms. The companies saw the tremendous growth that was beginning to occur in the newly established market for high-fidelity cassette recorders with noise reduction.

Dolby was able to convince them that (a) standardization on the Dolby B-type noise-reduction system would further stimulate the record industry to produce B-type encoded prerecorded tapes; (b) that the wide availability of cassette recorders and prerecorded tapes all with the same Dolby B-type noise reduction would establish confidence in the mind of the prospective purchaser of a cassette recorder with B-type noise reduction that B-type noise reduction encoded tapes, either commercially prerecorded or recorded on friends' machines, would continue to be available for a long time to come; and (c) once consumer confidence in a new product category is established, the long-term growth of the market can be assured. As a result of this, only one other complementary noise reduction system appeared on the consumer market up to 1976, and even this, JVC's A.N.R.S., had to be claimed compatible with Dolby B in order to sell.

It is interesting to contrast the growth and longevity of the market for high-fidelity cassette recorders with that for four-channel stereo, which started about the same time. Unlike the cassette recorder market, the four-channel stereo market suffered from several different and incompatible systems, the proponents of which spent more effort bad-mouthing each other than selling the concept of four-channel stereo to the consumer. The market for four-channel stereo died out completely before the end of the 1970s.

By the end of 1974, Dolby had 47 licensees including almost all the major manufacturers of consumer hi-fi audio equipment, and Dolby thought that there would be little need to negotiate many more new license agreements. This proved incorrect, since many new consumer applications of Dolby noise reduction opened up.

It is now used in such diverse applications as car stereos, music centers, portable radiocassettes, VHS video recorders and headphone stereos, and in each new field of application there were new specialist companies that needed to be licensed. New centers of production outside of Japan and Europe also opened up, all requiring individual attention as far as licensing is concerned. Dolby Laboratories now has about 160 licensees, of which about 100 are actually active. Dolby noise-reduction circuits are currently being produced at an annual rate of about 40 million, grossing about \$9 million per year for the company (about half the company's income); about 160 million are manufactured in about 35 countries. The various Dolby trademarks are registered in over 85 countries.

New System

In 1980, Dolby Laboratories introduced a new noise reduction system for the consumer market called Dolby C-type. It has also introduced improved ways to record on cassettes, Dolby HX in 1979, and Dolby HX Professional in 1982. This last innovation marks

Dolby's first licensing venture into the professional audio market. Dolby HX professional can not only be used in home cassette recorders, it can also be used to improve the recording quality of high-speed mass duplicated cassettes and the duplication mastering recorders.

The license agreement currently used for all applications is little changed from the third-generation agreement of 1971. New technologies are added to existing license agreements by using side letters. At the beginning of 1982, the royalty structure was changed to add royalty brackets that reflect the considerable increase in licensees' production volumes over what was envisaged in 1971.

The 10-cent bracket now only extends up to 250,000 processors, and an 8.5-cent bracket (250,001 to 1,000,000), and a 7.5-cent bracket (1,000,000 up) have been added. Also, playback-only processors such as are found in headphone portables and car stereos are counted as 0.75 of a processor for the purpose of counting royalties.

Dolby noise-reduction systems now account for about 95% of the sales of complementary noise-reduction systems in consumer products: Dolby Laboratories, Inc. is still a private company owned by Ray Dolby. Dolby has recently vacated the presidency of the company and is now its chairman. This new position will give him more time to devote to what he really enjoys doing—inventing.