

Why Sony Adopted Professional Disc™ Technology: An explanation of the advantages of new media choices for broadcast





Professional Disc media: the new generation media without compromise

What broadcasters and professional users value above all else is the content they produce, rather than the technology that creates it. They have to get the right content, at the right time and the right price, without compromise.

Sony has made a rigorous analysis of all the new and emerging technologies available for professional production and the Professional Disc technology stands out above all others for offering the economic and production benefits video professionals are asking for.

This document sets out the facts on why the Professional Disc media is the *ideal* new professional media. Like tape, it is low cost, robust and has a high recording capacity, but it is also nonlinear, exceptionally flexible and offers significant new workflow benefits.

One media: one cost

The Professional Disc media is designed to work throughout the production chain from acquisition to editing, playout and storage.

Nonlinear media

In creating the Professional Disc media, Sony considered a number of potential nonlinear options, but only the Professional Disc media meets the primary demands of professional users for a high capacity, robust, low cost media that is easily portable and works across the entire production chain.

DVD was rejected as being too limited for professional use. It has a top capacity of only 5GB, transfer speeds at just 11Mbps and isn't rigorous enough to cope with professional demands.

Beyond a few specialist applications, hard disk has issues with its size and weight, and the limitations it poses throughout the production chain. It needs an additional device for archiving and can be very expensive for large-scale implementations.

Solid state has a very high unit cost, low capacity, limitations of duration for recording HD signals and workflow restrictions – there is no flexibility for shooting or archiving. It is also projected to be many years before it has the capacity to handle meaningful amounts of picture information, let alone at a practical unit cost.

Professional Disc media extends the benefits of nonlinear across the production chain to acquisition, transforming the entire workflow. AV proxy content and metadata can halve transfer and editing times, while the ability to operate in at least two formats (MPEG IMX® and DVCAM™) doubles the production flexibility: for example, shoot drama today, news tomorrow.

The magic of the Professional Disc media is that it finally brings to life the dream of nonlinear recording with the flexibility of a low cost, robust, high capacity media and without the high cost and very low capacity problems of other nonlinear devices such as hard disk drives or solid state devices.

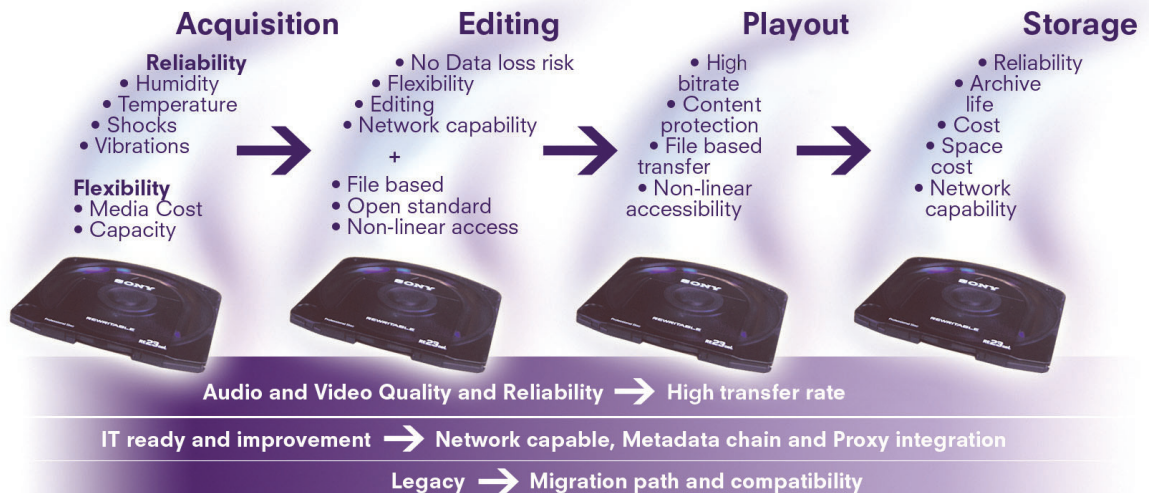
Solid state or hard disk devices have capacity and cost issues that currently make it hard to regard them as practical media for professional video production: they are, at best, buffering units. After a few minutes recording with a solid state device, the picture material has to be transferred to a second device to free up space to continue recording. The second unit has to be either a computer hard disk, for example on a laptop editing system, or a videotape machine – therefore all the benefits of nonlinear are lost. The very high cost of a solid state card makes it difficult to have more than a few at any one time. The alternative is to buffer to Professional Disc media. But why duplicate hardware costs with different devices for acquisition and archiving?

Professional Disc media is ideal for acquisition. Because of its high capacity, a camera person can record for up to 85 minutes at DVCAM format quality on a single disc. And the small size and the low unit cost means a large number of individual discs can be taken on a job, with potentially many hours of capacity instantly available. After all, this is one of the reasons tape has been so successful – and Professional Disc media maintains this benefit.

In the editing environment, Professional Disc media comes into its own. Transfer rates are extremely high and there is virtually no risk of data loss. And proxy AV files and the MXF format allows editing to begin instantly, even before the content has finished being transferred.

There are numerous network benefits with using Professional Disc media, including advanced metadata capabilities and the use of open standard industry files. These benefits extend to broadcast playout, where Professional Disc media combines the flexibility of tape with nonlinear accessibility, content protection and file-based transfers.

For storage, Professional Disc media is the only practical tapeless archiving media, offering an extremely long shelf life with low unit cost, space savings and network capability for easy access.





Media flexibility

Professional media has to be flexible for operators in the field. Consumers are more willing to compromise on quality if they need more capacity – or if they run out of capacity, they can simply stop shooting: professionals cannot compromise.



For example, a professional videographer shooting a wedding is paid to capture all the best moments of a unique day. That includes the father of the bride's speech in its entirety. The shooter needs enough capacity to shoot everything he needs and without compromising on quality.

This means he needs enough media to last the day. Three discs will give him over four hours of DVCAM material. Each disc records 85 minutes continuously, so the videographer is not changing media in the middle of the speech. And the discs are reusable a minimum of 1,000 read/write/erase cycles under specified conditions. In comparison, three solid state cards of 4 GB each would give much less recording time, while costing thousands of dollars. Also, does the shooter know precisely how many cards will be needed for the day?

If a news camera person has already recorded some vital footage for a news item, what happens if, when travelling back to the edit room, an unexpected event occurs that has to be recorded as well? Or if asked to shoot some additional shots, is the original footage recorded over due to the limited recording capacity of a solid state device? Or does the shooter simply insert a disc from their pocket?

If a documentary maker has to shoot an interview, how much media capacity should be taken? Buffering units such as hard disk drives or solid state are restricted by the high cost and low capacity. Even if a back-up device was available, does the interview stop just as it is getting interesting so as to download the recording from the solid state camcorder? With Professional Disc media, the shooter has much more recording time on a single disc than solid state. And they can afford to bring a number of discs and swap them over almost instantly without breaking the flow of the interview.

And what if an operator is on assignment overseas? How much media should be taken? With solid state, cost could be a restriction. With Professional Disc media, the low unit cost allows the operator to be generous with the allocation. And what if a disc is lost, stolen or confiscated? With a solid state card, this could be catastrophic and very expensive to replace. With Professional Disc media, the low unit cost makes it easier to bear the cost of replacement and also to have replacements at hand.

All professional users value their content above all else. The technology is merely the tool they use to capture and protect the content. Professional Disc media is the ideal nonlinear recording media that gives professionals the flexibility they need and have always expected from linear media. They should not have to compromise if the unexpected occurs.

Price / Performance

Price/performance is the most critical element for any mainstream professional tool.

The first generation Professional Disc media already has 23.3GB capacity, giving 85 minutes running time at DVCAM quality or 45 minutes at the Digital Betacam format equivalent MPEG IMX quality.

Hard drive and solid state devices are only applicable for very limited applications because the content always has to be transferred to a central server after a few minutes of shooting and the capacity remains extremely limited.

Currently hard drive and solid state storage cost hundreds of times the price of Professional Disc media per GB of capacity. Even as the price of all these technologies falls, the cost differential is not going to get significantly smaller for many years.

Professional Disc media with 23.3 GB capacity costs approximately \$30.

Migration to HD

As the world leader in HD production technology, Sony has a clear migration path for taking Professional Disc to HD.

Shoot 16:9 SD today with the confidence that Sony is planning to offer an easy, efficient upconversion path to HD.



Robust design

Sony has designed the XDCAM product range to the same rigorous standards it has always applied to its professional tape based products, from DVCAM to the industry leading standard, Digital Betacam format. XDCAM products have been tested in the most extreme conditions, from the freezing cold of a New Zealand mountain winter to the choking heat, dust and jarring terrain of the Australian desert outback.



XDCAM products are designed to function normally in temperature extremes and have been tested with success in lows of -22°F to highs of 131°F. (Refer to the Operators Manual for recommended operating conditions).

The disc is protected in a rugged plastic cartridge that gives it exceptional resistance to external constraints, such as physical shocks, vibration, extremes of temperature, magnetic fields and x-rays.

Tests in the field have subjected XDCAM camcorders to continuous vibration for many hours while recording, for example in 4x4 vehicles driving over rugged terrain, with no adverse affects on the pictures. (Footage of XDCAM product trials can be viewed on the Internet at www.sony.com/xdcam)

Key to the rugged design is a new generation of professional blue laser optical recording technology, which eliminates wear to the disc's surface. With the laser working at temperatures of over 1110°F, there is no adverse effect from outside temperatures. The robust design also allows individual disc units to be recorded well over 1000 times and to be replayed over one million times based on Sony testing done under ideal conditions (73°F, 50% relative humidity). Because there is no contact between the recording laser head and the disc, XDCAM products work normally in humidity up to 99 per cent. (Refer to the Operators Manual for recommended operating conditions.) This is all far more reliable than professional tape.

The professional blue laser optical recording is a completely new implementation of technology, bearing little comparison to the consumer Blu-Ray Disc™

technology – rejected for professional use because of its lower transfer speed and limited robustness. The blue laser technology features much faster transfer speeds – up to 144 Mbps for writing and up to 170Mbps for reading – and a much more robust design.

The protective cartridge of the disc, combined with the XDCAM's products tried and tested loading mechanism, virtually eliminates the possibility of damage when inserting the media in the camcorder or recording device. In comparison, devices that use PIN connections can be damaged from continual use and such damage could mean a cost of many thousands of dollars to repair.



Low maintenance

XDCAM camcorders and decks have been designed with almost no moving parts. Those parts that do move have an extended life duration, so maintenance costs are reduced, typically by more than 50 per cent based on parts costs alone when compared to professional tape-based mechanisms.

Indeed the recommended replacement interval for the optical block is 6000 hours in the deck and 4000 hours in the camcorder, compared to a typical 2000 hours for a tape-based mechanism in a deck or a camcorder.

In any event, Sony gives a 7 year "Powertrain" warranty on all its optical drives, adding to the confidence users can have in the system! (See actual warranty for details).



06/07

Complete production chain

Sony understands that professionals need solutions that work across the complete production chain, while optimizing the cost for the user. There is limited benefit from having one kind of capturing device in acquisition and another for editing and storage. Professional Disc media works from acquisition to editing to playout to storage.



Sony has launched a line of camcorders and decks to support the professional disc medium. The 'XDCAM' products are geared to a range of production applications and includes: PDW-530 camcorder that records both DVCAM and MPEG IMX signals, the PDW-510 camcorder that records DVCAM format, the PDW-1500 compact deck and the PDW-V1 mobile deck.

Few customers can afford to have terabytes of hard drive available for storage. So, solid state or hard disc customers would need to buy additional devices on tape or disc for additional storage and archive. This means duplicating equipment purchases, adding further to the high cost of purchasing solid state or hard disc equipment.

Professional Disc media is the only practical nonlinear storage solution because of its flexible and low cost.

The high capacity of the disc means entire programs can be stored on a single disc and even large amounts of rushes can easily be handled. The very low unit cost – similar to tape – means this storage is also very cost effective.

Because of the multiple recording capabilities of Professional Disc media – recording both DVCAM and MPEG IMX signals, in PAL or NTSC – fewer machines are required and the same recording deck can be used for editing and archive. This significantly reduces the overall cost of investment. All XDCAM products are networkable, with simple interfaces, allowing the "pooling" of equipment in the production environment: typically one XDCAM deck can be shared with several nonlinear editing systems over a network, as opposed to the traditional requirement of one VTR for each nonlinear editor.



Faster start-up and transfer times

XDCAM camcorders have extremely fast start up times. Operators can start recording almost as soon as they switch through a cache function for the first three seconds while the disc unit ramps up to speed. This means recording can start almost as soon as the operator inserts a disc and closes the cover.



XDCAM products have also been designed to have the fastest transfer times practically possible. XDCAM dual laser decks have a writing speed of 144Mbps and a reading speed of 170Mbps, representing up to five times real-time transfers for DVCAM material to a computer and up to two and a half times real-time transfers for MPEG IMX material. This is at the limit of internal data transfer rates for most computer drives available today.

To further speed up the editing process, XDCAM products feature the latest proxy recording system, ProxyAV. With ProxyAV, a low resolution copy of the video and audio content is recorded on the disc at the same time as the high resolution DVCAM or MPEG IMX content. Due to its limited size, it can be used for fast browsing or for transferring onto computers at very high speed for faster editing and content sharing, with up to 50 times real-time transfers. This allows editing to begin as quickly as possible without any loss of the nonlinear benefits of Professional Disc media.

Open industry standards

Professional Disc media is an open solution. Besides handling DVCAM and MPEG IMX material, the system uses standardised MXF files defined by the Pro-MPEG Forum. Professional Disc technology can also handle various meta-data standards, such as EDL, text, GPS, UMID and Script.



Each disc has allocated space for 500MB of pure data storage into which users can put any information they need (for example Word® documents, Excel® files, etc).

Many companies, such as Avid, Pinnacle and Quantel, have announced their support for the XDCAM system and have already demonstrated interoperability at NAB and IBC 2003 and 2004. To make compatibility easy, XDCAM products use SMPTE standard MXF files. The MXF file format has already been adopted by more than 20 companies worldwide.



08/09

Professional Disc Media: flexible, low cost media

Professional Disc is the perfect, flexible media. Because it is high capacity and low cost, operators can take as much media storage on location as they require. If, by some misfortune, an individual disc gets lost, damaged or is confiscated, a replacement is cheap and easy to obtain. In comparison, if a solid state device is lost or damaged, the replacement cost is extremely high and few operators are able to afford more than one anyway.

It is often hard to be precise about how much recording will be needed on a job. For example, interviews can run on long after they are expected to finish. With Professional Disc media, it is very cost effective to take extra discs.

The discs are small and lightweight – a disc plus cartridge measures a compact $5\frac{5}{32}$ " x $\frac{1}{32}$ " and weighs just 3.1 ozs. – and other, even smaller, versions are planned to be available in the future.

At the same time, Professional Disc media is ideal as a long storage and archive media because of its high capacity and low cost. The media's life is projected to be up to 50 years, based on Sony's accelerated testing.

Professional Disc media is a low cost, high capacity, nonlinear media that has been designed to meet the practical needs of video professionals today and in the future, where performance and cost are the two main drivers.



Some misconceptions about Professional Disc technology

1. XDCAM products have an operating temperature of 41 – 131°F (5 – 55 Degrees Celsius) because of the heat recording mechanism of a phase change disc. (Refer to the Operators Manual for recommended operating conditions).

Wrong. Phase change recording is at between approximately 750 – 1110°F. Therefore the external influence of low or high temperatures is negligible. Numerous customers who have tested the XDCAM prototypes have confirmed this.



PDW-530 Camcorder record test at -22°F performed by WDR in Germany.

2. There is a recording delay at power up and disc change.

Wrong. Loading time is shorter than tape and the XDCAM system's cache memory function enables users to start recording almost immediately.

3. XDCAM gear cannot withstand continuous vibration such as in-car or helicopter shooting.

Wrong. XDCAM gear has proven itself to be extremely resistant to extreme shocks, G-force and continuous vibration. Various technologies are implemented in the products to allow that high level of performance. (Footage of XDCAM product trials can be viewed on the Internet at www.sony.com/xdcam)

4. XDCAM drives have only a 2000 hours lifetime.

Wrong. The XDCAM camcorder has a projected drive lifetime of at least 4000 hours and the recorders have a projected drive lifetime of 6000 hours. In addition, the drive replacement cost is 50 per cent cheaper than tape drums based on parts replacement costs alone. In any event, Sony offers a 7 year "Powertrain" warranty on its optical drives. (See actual warranty for details).

5. XDCAM technology is restricted to 12cm disc sizes.

Wrong. Sony continues to study the best way to progress in terms of the size and capacity of Professional Disc media and users can expect further announcements as new products are launched.

6. There is no clear migration to HD.

Wrong. Due to its bit rate and high disc capacity, HD is possible on Professional Disc media already and its implementation is under study.

Why the XDCAM Professional Disc system?

A summary

- **Low unit cost:**
Approx. \$30 for 23.3GB
- **High capacity:**
23.3GB allows 85 minutes at DVCAM quality
- **Available now:**
complete line-up from the start
- **Advanced blue laser technology:**
not Blu-Ray, very low maintenance
- **High transfer speeds:**
up to 144Mbps writing and 170Mbps reading
- **Advanced workflow benefits:**
open standards, metadata handling, networkable
- **HD capable:**
sufficient bit rate and capacity to handle HD recordings
- **Robust:**
not affected by vibration or humidity or extremes of temperature



The XDCAM system delivers all the benefits of current tape media...



All these additional benefits, making the Professional Disc system the clear new media choice for the future.

Tape

Maintain tape's basic benefits

- Reliability
- Affordable to use same-media throughout entire production process
- Editing, capture & archive capable



Workflow innovation

- High speed editing
- High speed browsing → Proxy creation
- Content management
- Content sharing
- Emergency broadcast
- Content reference → Metadata capabilities
- Database management
- Content sharing → Network accessibility
- Hardware cost reduction → SNMP capability
- Equipment control → Format independent media
- Openess

Nonlinear media benefit

- File based acquisition
- High speed transfer
- Direct access
- Highly recyclable



XDCAM
Professional Disc System

Cost of ownership reduction

- Infrastructure cost reduction → Single media able to cover ALL applications
No double cost for acquisition & archive
Network capability to share devices
- Media cost reduction → Highly reusable media

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