

Sony Electronics, Inc.

**3300 Zanker Road
San Jose, CA 95132-1940
866-335-SONY (7669)
www.storagebysony.com / www.aittape.com**

Sony's AIT-3: Measuring Up to New Demands Upon Tape

Preface

Information Systems (IS) organizations are acutely aware of the importance of tape. Business continuity/disaster recovery depends on the ability of tape to respond effectively to a crisis. Moreover, enterprises are coming to realize that they cannot cope with the increase in the demand for storage by keeping everything online on disk.

Older open system tape technologies do not always meet the challenges that enterprises require from tape. New open system tape technologies have been developed to meet three essential characteristics:

- *Scalability* — accommodate more data on each tape cartridge
- *Performance* — minimize both the backup window and the time to restore data
- *Reliability* — significantly reduce the time and effort to work around the failure of a tape

IS organizations are focusing on delivering more to the enterprise while simultaneously keeping a strong emphasis on cost containment. Storage consolidation and improving the backup/restore process are high on their agenda, according to Aberdeen research. In addition to scalability, performance, and reliability requirements, enterprises seek tape technology that is cost-effective, delivers media investment protection, and fits in with their current and future needs.

Sony's Advanced Intelligent Tape (AIT) technology illustrates an open system tape technology that rises to face the challenges that tape must meet. This *Aberdeen Profile* examines Sony's AIT-3, the third generation of AIT technology. AIT-3 delivers the scalability, performance, and reliability that enterprises require at a cost-

effective price — and with a tape drive compactness that yields space savings in any consolidation.

Executive Summary

AIT is Sony's tape technology platform for open system environments. Unlike the other new breeds of open system tape technologies that are still in their first generation (or at the beginning of a second generation), AIT-3 is in its third generation. Sony manufactures both the tape device and the tape media for these drives.

AIT-3 uses a helical-scan technology rather than linear technology. What matters to IS organizations is not the way bits are laid down on a tape cartridge, but what that means in terms of characteristics that are valuable to an enterprise — capacity, performance, and reliability.

At 100 GB native (e.g., uncompressed), an AIT-3 tape cartridge compares favorably with the new breeds of tape technology. Because AIT-3 can fit more bits/inch than a linear tape technology and an AIT-3 cartridge is not so wide as a half-inch linear tape cartridge, an AIT-3 tape cartridge is physically much smaller than a half-inch linear tape cartridge. Thus, tape libraries that use many slots that contain AIT-3 media can store significantly more data within the same space than those that use half-inch linear tape cartridges. Space-conscious co-location facilities are an example of where space-saving tape automation can play well. Moreover, in general, IS wants to consolidate — good — rather than expand — bad — within the confines of any location.

AIT-3 has a sustained transfer rate of 12 MB/s native. That is a little less than comparable to half-inch tape technologies, but that difference should not be significant to most IS organizations.

As the quantity of data that is stored on tape continues to grow rapidly, the need for reliability in tape drives and media has increased commensurately. The newer tape technologies — such as AIT — have risen to face the challenge. Sony states that the MTBF (mean time between failures) for AIT-3 is 400,000 hours — based upon current field experience — at 100% duty cycle, which is quite high for a tape drive.

AIT-3 also offers additional features that can benefit many enterprises. Backward read *and* write capability with both previous generations of AIT enables organizations that currently use an earlier generation of AIT to preserve their investment in existing media (recognizing that the older tape cartridges retain their original capacity). Average file access times of less than 30 seconds are important for enterprises that want to be able to retrieve specified files quickly, but not at random access speeds. Special WORM (write once, read many) tape cartridges fulfill legal and regulatory requirements without having to introduce and manage another technology and without having to pay high-end WORM tape technology prices.

Sony has a justifiable and proud record in delivering innovative, highly functional, high-quality products for consumers, professional media and entertainment companies, and general business. AIT is a continuation of this tradition in the open system environment.

Getting the Most Bang per Bit

IS managers are concerned with only the outcomes that come from a tape technology — scalability, performance, and reliability. At first glance, IS managers do not seem to require an understanding of the differences between helical-scan and linear tape technology. But that is not the case.

Many benefits that enterprises can derive from AIT technology come from the fact that AIT-3 has an areal density of about five times that of linear tape technologies. Areal density is the data that can be stored on a square inch of media. So an 8-mm (about a third-of-an-inch-wide) tape can hold as much data (100 GB uncompressed) on 230 meters of tape as a half-inch linear tape can hold on 600 meters.

The tape media uses Advanced Metal Evaporated (AME) technology, the secret sauce that yields high capacity with high durability. AME creates a recording layer of nearly 100% magnetic material in contrast to typical linear tape technologies that may have less than 50% of magnetic material in a layer. Higher areal density is the result, as well as a smoother tape surface that significantly prolongs head and media life.

Space-Saving Tape Automation

Higher areal density means that both AIT-3 tape drives and media can be physically smaller than linear technology-based tape drives and media for the same capacity. An internal AIT-3 tape drive has a width of only 3.5 inches and a height of less than one rack-mountable unit (1U, or 1.75 inches), compared with the dimensions of a typical tape drive for a half-inch linear tape drive — 5.25 inches wide and a height close to 2U. However, providing smaller cartridges is the principal reason that tape libraries for a given capacity can be smaller with AIT-3 than with linear tape libraries. A small tape library (where a tape library means a minimum of two tape drives with the appropriate robotics) can take up only 2U (and even 1U in some cases) of standard rack space.

Most of the leading tape automation suppliers offer AIT tape libraries as an option, and a couple focus on AIT exclusively or primarily. Each company has different specifications, but with compression, an AIT-3-based tape library can exceed 30 TB/square foot, 150 TB of total capacity, and more than a TB/hour performance.

Space-conscious IS organizations can therefore squeeze tape automation into a tighter place — a feature that is never bad, and, in some cases, may be essential.

Getting the Most Out of a Standard Form Factor

Enterprises may have very high end capacity and performance requirements that existing open system tape technologies cannot address. A flip side to shrinking a tape drive while giving equivalent capacity and performance is to offer a standard 5.25-in. wide drive with half-inch tape and 600 meters of tape, but with enhanced capacity and performance.

S-AIT (where S stands for Super) tape technology will offer these features. For enterprises that can use 500 GB native from a capacity perspective or 24 MB/s from a performance perspective, S-AIT is the answer.

Sony is using the technology base that was invested in developing AIT-3 and is scaling it up into a larger form factor. Thus, Sony can do this scaling up without inventing any new tape technology physics (e.g., heads and media). Instead the scaling up is a mechanical engineering project to handle the larger media size. With this larger mechanism, Sony can also include many more read/write heads for improved data transfer rates.

All in the Family

Enterprises benefit not only from AIT-3 and S-AIT, but also from preceding generations of AIT technology — AIT-1 and AIT-2 (Figure 1). Sony balances capacity/performance with price for each generation where the current generation costs no more than competitive products. For organizations that may want to migrate from DDS (Digital Data Storage) technology — and are very price sensitive — AIT-1 is Sony's offering. For those organizations that need more than what AIT-1 offers, but do not need the capacity or performance of AIT-3, AIT-2 would be the choice.

AIT-3 is backward read/write compatible with both prior generations of AIT. Backward read *and* write capability may be attractive to many enterprises, and neither of Sony's major competitors can claim to offer this feature. In environments with more than one generation of a tape technology, backward read capability is commonly used for IT departments to mitigate migration to the newer tape technology.

Backward write capability is uncommon except for Sony's technology. An AIT-3 drive can read/write an AIT-1 tape cartridge at 8 MB/s — twice what the AIT-1 can do alone and can read/write an AIT-2 tape cartridge at 12 MB/s — twice what the AIT-2 drive can do by itself. Enterprises can therefore migrate from AIT-1 and maintain — if they wish — their investment in an existing tape media. Although capacity remains at the original level by necessity, IS managers can take advantage of the faster speed of the new tape drives.

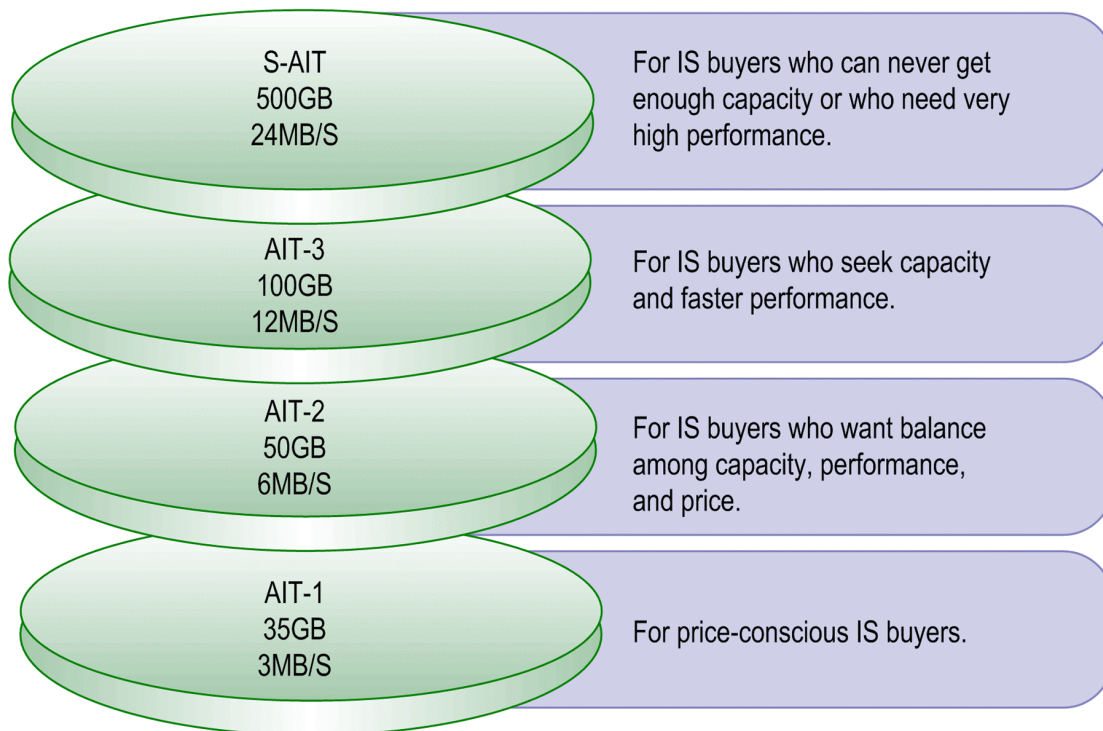
Reliability

The reliability of tape technology is critical to IS departments, as any IS administrator who has had to work around a tape failure during a file restoration process can attest. AIT-3 holds to a high standard with a claim of 400,000 hours MTBF at 100% duty cycle. Several factors account for this level of reliability. With helical-scan tape technology, the read/write heads move rather than the tape so there are no problems caused by tape moving at high speed. AIT tapes are also dual reel, thereby limiting tape threading or pulling on a tape leader.

Performance

The growing amounts of storage that requires backup to tape and the need to shrink backup windows to keep applications online longer are resulting in storage demands that the older open system tape technologies are not able to meet. At 12 MB/s of data throughput, AIT-3 is able to overcome the limitations of older technologies and compete favorably with new open system tape technologies. Another aspect of performance that may be very important to many enterprises is average access time. Relative to other new open system tape technologies, AIT-3

Figure 1: Something for Every Need and Every Pocketbook



**Note: All numbers are native.
Source: Aberdeen Group, July 2002**

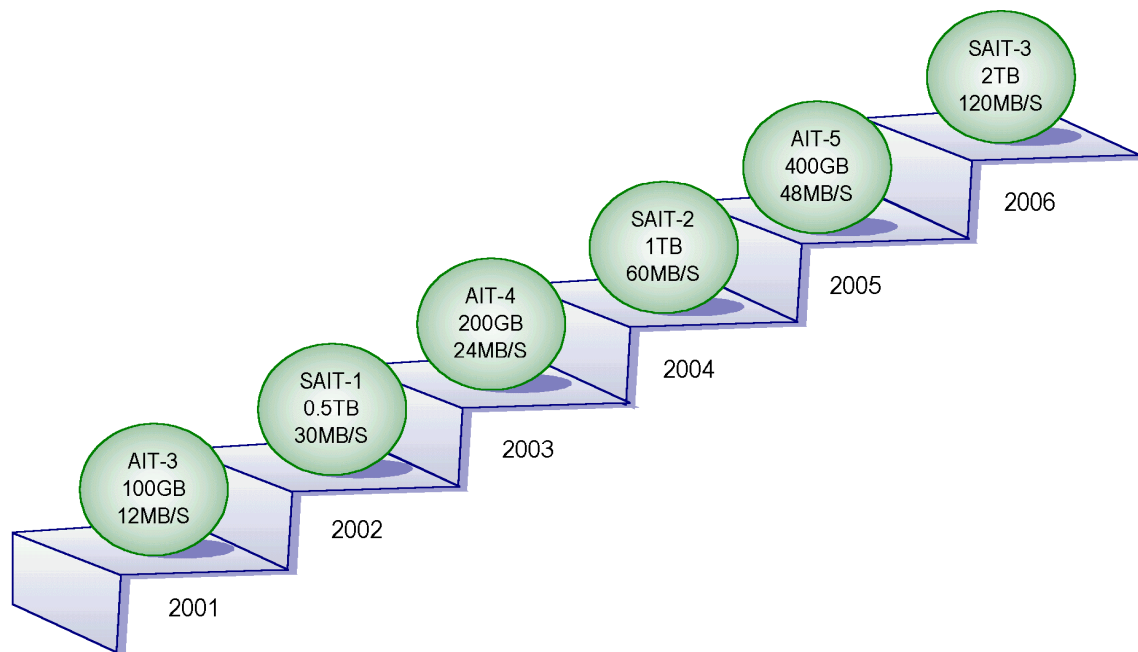
has both a fast load and a fast search capability. Searching 230 meters of tape versus 600 meters of tape means that only about a third as much tape has to be scanned. The net result is that IS managers can use AIT-3 for nearline applications and streaming applications, such as backup and restore. Organizations are realizing that not all content, such as older e-mails and attachments, as well as even completed transactions, need to be kept online. Also, large files, such as video, may not be economical to keep on high-speed online disk. AIT-3 can very well serve these nearline applications that many organizations have today and that more will have soon.

The AIT and S-AIT Road Maps

Sony has announced a multigenerational roadmap for both AIT and S-AIT. S-AIT is, of course, AIT's 8-mm technology adapted to a half-inch format (Figure 2). Sony will introduce each generation of AIT first and then follow up with the same density version of S-AIT in the following year. Sony has a long track record that demonstrates its engineering expertise. Two years is a reasonable time frame for succeeding generations.

Developing a new generation of a tape technology requires a high level of technical expertise, such as the development of new read/write head technology or the

Figure 2: Climbing the Ladder: AIT and S-AIT — A Game of Leapfrog



Source: Aberdeen Group, July 2002

use of new magnetic coating technology. The year lag between the introduction of an AIT technology and its corresponding S-AIT counterpart ensures the enterprise that Sony is allowing enough time to make the mechanical engineering changes to the new generation of base AIT technology.

AIT and S-AIT benefit from having the common technology base, but they address two different needs of enterprises. AIT matches up with a broad range of open system tape requirements, whereas S-AIT concentrates on the high end of the enterprise's tape needs, where only the highest capacity or highest performance is a must.

Unalterable Information

Many enterprises have renewed interest — for legal, auditing, and regulatory reasons — to preserve information as it was originally created without the threat of alteration. To do that requires a WORM technology. Optical WORM storage technologies may be suitable for some requirements, but scalability may be an issue. Moreover, most enterprises already have an established media management system for managing tapes throughout the tape lifecycle. Sony offers AIT-3 WORM cartridges that satisfy that business requirement. Although high-end tape technologies may offer WORM capability (at a higher price), typical open system tape technologies do not offer this feature.

Even IS organizations that have not previously given any consideration to WORM technology or have confined their WORM requirements to a single targeted application using optical technology may find that having WORM technology that can scale using existing media management software may become a more important consideration as time goes on. IS managers may find that it is a lot easier to add WORM tape cartridges to the mix with the standard read many/write many tape cartridges than it is to introduce a new sequential recording technology.

I Is for Intelligent

The “I” in AIT stands for intelligent. Wherever intelligence is used with a storage product, a chip gives the product its “intelligence.” Embedded into every AIT data cartridge is a Memory-in-Cassette (MIC) chip, a 64-kbit memory chip. The tape's system log, search map, and user-definable information stored on the MIC chip enables applications to take advantage of the much faster access speed, which the MIC chip provides. The ability to restore a single file or group of files for a particular user can result in improved end-user satisfaction for the performance of an IS organization.

Through the application of tape partitioning, the AIT technology can also be used for volume stacking. Each logical volume can be contained in a separate physical partition to enable greater utilization (and therefore better asset management) of each tape cartridge).

Unfortunately, typical backup/restore software packages have not been programmed to take advantage of the MIC capability. However, an enterprise may find that the MIC solves a very real problem and be willing to find the software that takes advantage of this capability. Even if this is not the case, however, enterprises recognize that Sony is innovative and is putting capabilities in place that they might be able to capitalize on in the future.

Aberdeen Conclusions

AIT-3 has the capacity, performance, and reliability to serve as a tape technology for the workhorse backup applications that every enterprise needs. Moreover, as enterprises increasingly realize the importance of content-based applications that have lower frequency of access and do not demand instant access, AIT-3 can play a significant role because of its average file access times of less than 30 seconds.

Although IS buyers can buy AIT tape drives and media from a number of tape automation suppliers, Sony is the one source for both tape drives and tape media. There are two reasons that IS buyers like alternative suppliers for the same tape drive or media technology — price and assured delivery. Practically, the prices of all open system tape technologies are competitive, so that is not really an issue. Assured delivery really gets down to whether there are two sources of supply. Sony has dual manufacturing sites, so delivery assurance should not be a real concern of an enterprise.

Sony has a long and honorable record in tape, and the roadmap extends that. First, Sony spawns a generation of AIT and then will spawn a corresponding generation of S-AIT. IS managers can have the confidence that Sony has the experience in tape and can rest assured that Sony has always had a long-term perspective. Aberdeen suggests that those organizations that are evaluating open system tape technologies strongly consider AIT-3.

To provide us with your feedback on this research, please go to www.aberdeen.com/feedback.

*Aberdeen Group, Inc.
One Boston Place
Boston, Massachusetts
02108
USA*

*Telephone: 617 723 7890
Fax: 617 723 7897
www.aberdeen.com*

*© 2002 Aberdeen Group, Inc.
All rights reserved
July 2002*

Aberdeen Group is a computer and communications research and consulting organization closely monitoring enterprise-user needs, technological changes and market developments.

Based on a comprehensive analytical framework, Aberdeen provides fresh insights into the future of computing and networking and the implications for users and the industry.

Aberdeen Group performs specific projects for a select group of domestic and international clients requiring strategic and tactical advice and hard answers on how to manage computer and communications technology. This document is the result of a commissioned research effort between Aberdeen Group and Sony Electronics, Inc.