

AIT and SAIT Technology Backgrounder



With the volume of corporate data typically exploding by 60 percent a year, there is a pressing need for reliable, high-performance, large-capacity data protection and archival products. Historically, tape drives have offered the most economical solution, but by the mid-1990s, conventional tape systems were rapidly reaching their limit as cost-effective and space-efficient data storage media.

In 1996, Sony achieved a breakthrough storage solution with the introduction of Advanced Intelligent Tape™ (AIT) technology, a product of Sony's 50 years of innovation and technological excellence in magnetic recording techniques and mechanisms. The AIT format is a future-oriented technology that sets new, progressive performance and capacity standards for high-density data recording. AIT drives and media are characterized by 8mm tape in a compact 3.5-inch cartridge, a helical-scan recording technique, unique Memory-In-Cassette (MIC) capabilities, HyperMetal™ laminate head technology, and the exclusive use of Advanced Metal Evaporated (AME) media. AIT also relies on Adaptive Lossless Data Compression (ALDC) to achieve a remarkable 2.6:1 data compression ratio.

SAIT – A New Tape Technology for the Enterprise

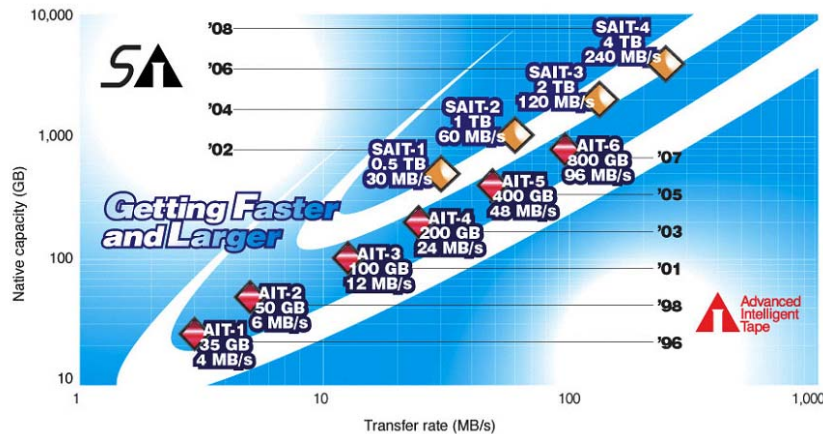
Although the capacity per cartridge of current technologies on the market are projected to increase in the future, they are not expected to reach the more aggressive industry roadmap goals of 1 terabyte (TB) per cartridge by 2006 and 10 TB per cartridge by 2011 without major new technology breakthroughs in media formulation and mechanism designs. In fact, the current tape formats are not expected to break the 1 gigabit per square inch areal recording density frontier until the end of the decade. At this rate, the capacity per cartridge will barely exceed an uncompressed capacity of 1 TB.

Leveraging AIT's superior areal density, Sony concluded that using a longer and wider AIT media in a single-reel configuration, five times the capacity could be achieved for any given AIT areal density design point. Thus, the SAIT™ family concept was born with a starting uncompressed capacity point of 500 gigabytes (GB) per cartridge, delivered to the market in early 2003. Using the published AIT areal recording density roadmap, a family of four SAIT members was immediately identified.

This new SAIT tape technology platform delivers high capacity and high performance using a half-inch, single-reel tape and a 5.25-inch full-height mechanism design, dramatically improving the value proposition between conventional tape roadmaps and future hard disk drive capacity trends. As a new class of tape solution, SAIT technology leapfrogs current solutions in the market, offering significant advantages in capacity, performance, reliability and scalability.

Sony's Current SAIT Lineup

Sony started shipping qualification units of its first-generation SAIT drives in the winter of 2002. SAIT-1 boasts an unprecedented storage capacity of up to 1.3 TB of compressed data (500 GB native) per half-inch tape cartridge, designating it the first tape format able to hold over 1 TB on a single cartridge. SAIT-1 also features a sustained transfer rate of up to 78 megabytes (MB) per second (30 MB per second native). The SAIT roadmap extends to a fourth generation (SAIT-4), with a goal of doubling capacity and performance with each subsequent generation every two years. SAIT-4 will feature up to 10.4 TB of compressed capacity (4 TB native) on a single cartridge.



Sony's Current AIT Lineup

The AIT technology platform has been continuously enhanced since its introduction in late 1996, and now delivers an impressive 100 GB native capacity and a 12MB per second native data transfer rate. Sony has met its promise to the industry by its on-time execution of the AIT roadmap through three generations. AIT technology fills the price point gap between low-end DDS and high-end enterprise tape storage solutions. For those customers that require higher capacity and better performance without a drastic change in drive or media form factor, AIT-1 and AIT-2 provide a natural bridge from the low-end tape roadmaps to the more robust midrange AIT technology.

With the introduction of AIT-3, Sony's tape storage offerings were broadened to include three generations of the AIT format to serve tape back-up and archive markets from the desktop to the enterprise. It also extended the AIT storage platform to more than 300,000 drives in use providing a breadth of customer storage solutions and applications. The longevity, easy maintenance, proven scalability and compatibility of the AIT family further underscores the investment protection offered to customers that migrate to an AIT solution.

AIT-4

The planned introduction of AIT-4 will mark yet another innovation in fast-access, high-density tape recording technology, and will continue the broad adoption and expansion of Sony's AIT architecture. Achieved through technological advances in recording heads, channel coding, media formulation, mechanism design, and Sony-produced LSI chips, this fourth-generation AIT product will offer capacity, performance and reliability unmatched by any other tape drive system in its price class.

Fully backward read compatible with AIT-1 and AIT-2, together with full read and write compatibility with AIT-3, the AIT-4 drive will provide a data transfer rate (24 MB per second native) and capacity (200 GB native) unmatched by any 3.5-inch mechanism or 8mm media technology on the market.

SAIT and AIT Common Technology Enablers

Advanced Metal Evaporated (AME) Tape for Longevity

The exceptional capacity, virtually contamination-free environment, and head/media reliability of AIT and SAIT products is made possible by the use of Advanced Metal Evaporated (AME) tape with Diamond Like Carbon (DLC) coating. This unique coating method, by which pure metal (cobalt) material is vaporized and deposited directly on the base film, results in virtually 100 percent magnetic material. The resulting tape is smoother and thinner than conventional tape, which contains painted-on coating and only 50 percent active magnetic material. The extra durability, performance and reliability characteristics of AME apply to both AIT and SAIT implementations and enable leadership achievements in areal recording density (700 megabits per square inch), head life (50,000 hours), media uses (30,000) and reduced drive maintenance. In addition, the shelf storage life of the media under normal environmental conditions is estimated to be in excess of 30 years.

Memory in Cassette (MIC) and Remote-Memory in Cassette (R-MIC)

The inventive and non-volatile MIC chip, which is built into the data cartridge, provides quick media load and fast access to user files — ideal features for data-intensive environments such as video servers, digital image management and data collection. Also, MIC cassettes do not need to read the tape to access the system log.

Another benefit of MIC is media security. Since the tape system log and other user-definable information are maintained separately from the tape, chip contents can always be accessed, even if the media is reinitialized. The media is also permanently protected from erasure in other drive mechanisms through a cartridge interlock and write protect system.

AIT and SAIT WORM

With the recent upsurge in critical data creation, coupled with heightened data security concerns, Sony recognized the need to enable perpetually secure data backups for companies with livelihoods that depend on them. AIT and SAIT WORM (Write Once, Read Many) drives and cartridges will allow users to save data where it can be accessed whenever necessary, but not easily re-written or erased. This feature will minimize accidental data loss or the possibility of alteration of archived records. The end result is an extremely cost-effective storage technology for those storing sensitive data from financial, securities, education, government, medical and insurance organizations.

WORM has the multi-functional characteristics of being compatible with the conventional erasable media versions of the AIT and SAIT technology families. Only the WORM cartridge supports write-once characteristics, which were achieved by incorporating special capabilities into the WORM media cartridge and by upgrading the drive's firmware. The presence of the WORM cartridge inhibits the tape drive from overwriting data, while still allowing additional data to be appended, up to the capacity limitations of the media.

AIT and SAIT Reliability

The reliability of SAIT and AIT drive systems results, in part, from innovative features designed to provide a controlled operating environment. The drive constantly monitors head output and invokes the built-in Active Head Cleaner when it senses possible contamination, reducing the need for periodic head cleaning. The cooling system for the electronics prevents particulate matter from entering the tape path and affecting critical components.

The SAIT design builds upon the innovative features of AIT drives to ensure reliability and performance. SAIT utilizes a dual-mode tape path, delivering smooth operation and minimal tape wrap when fast-forwarding and rewinding or performing a high-speed search. For further reliability, the drive cooling system is isolated from the tape mechanism, thereby limiting airborne contaminants from entering the tape path and affecting sensitive components. Airflow under the sealed deck provides effective cooling of the electronics and drum motor.

AIT Forum

The AIT Forum, founded in 1999, is an industry consortium of hardware and software companies dedicated to advancing the art of data storage and protection through the widespread adoption of AIT drive and format technology as an industry standard. The AIT Forum lays the groundwork for greater industry support of the AIT tape format. By bringing together system, tape automation, media, and component manufacturers, the Forum provides the basis for future technology innovation and leverages the combined skills and resources of the Forum members to meet the intense data storage demands of end-users.

The AIT Forum convenes semi-annually to discuss new AIT and SAIT developments, technology enhancements and impending new products. Working groups have also been established and provided a venue for members to collaborate on a variety of marketing, specification and standardization efforts.

Additionally, members cooperate regarding the content of the AIT Forum Web site (www.aittape.com) and produce a newsletter that offers application and customer success stories, storage trends, technology developments and working group updates

Founding members of the AIT Forum include ADIC, Cybernetics, Hewlett-Packard, Matsushita Media Group, Overland Storage, Qualstar, Sony, Spectra Logic, and VERITAS Software.

Additional Forum members include BakBone Software, BCC Technologies, Computer Associates, Cristie Data Products Limited, Dantz Development, Dynamic Solutions International, GID, GRAU Data Storage, Hitachi Data Systems, LaCie, Legato Systems, NEC, Network Appliance, NovaStor, PeakStorage Solutions, Plasmon, Rorke Data, StraightLine, TapeLabs, Toshiba, Ultera Systems, Unisys, XenData, Xerox and Yosemite Technologies.

Milestones in the Development of Sony Tape Technology and Recording Drives

- 1950 - Stationary head device, first audio recorded
- 1963 - Portable video recorder with helical scan
- 1977 - One-inch video tape recorder
- 1985 - 8mm video tape recorder
- 1987 - Mass production technology for metal vapor deposition tape
- 1987 - Digital audio tape (DAT) and component digital VTR (D-1) for broadcast use
- 1989 - Digital Data Storage (DDS)
- 1990 - Hi 8ME, 8mm cassette for broadcast use
- 1993 - Component digital VTR Betacam for broadcast use
- 1994 - Diamond Like Carbon protective film and super durable, AME tape
- 1996 - Sony introduces Advanced Intelligent Tape (AIT) Technology**
- 1996 - AIT technology using AME tape introduced
- 1996 - AIT-1 wins "Best New Technology Award" from *Byte Magazine*
- 1997 - AIT-1 format approved as an industry standard by European Computer Manufacturers Association (ECMA)
- 1998 - AIT-2 technology announced
- 1998 - AIT-1 enhanced from 25 GB to 35 GB
- 1999 - AIT-2 begins customer shipments
- 1999 - AIT Forum created in Denver
- 1999 - AIT prototype demonstrates 1Mb/in.² areal density
- 1999 - AIT-2 format approved as an industry standard by ECMA
- 2000 - Sony Dothan, AL produces AIT-2 media
- 2000 - AIT-2 won the "Storage and Peripherals Award of the Year" by *Imaging & Document Solutions Magazine*
- 2000 - Sony, HP and Compaq create "Auxiliary Memory" ANSI specification
- 2000 - AIT-3 technology announced
- 2000 - AIT-1 value series introduced & data transfer rate enhanced to 4.0MB per second
- 2000 - Sony forms Tape Storage Solutions Division in Japan and United States
- 2000 - AIT prototype demonstrates 6.5Gbit/in.² areal density
- 2001 - Sony announces the introduction of AIT WORM drives and media
- 2001 - Sony delivers AIT-3 drives and media to the market
- 2001 - Consortium of storage companies approves R-MIC specification
- 2001 - Sony introduces SAIT Technology**
- 2002 - Sony shatters areal density record by demonstrating 11.5 Gbit/in.²
- 2002 - Qualification SAIT-1 drives and media start shipping to OEMs
- 2003 - Production SAIT-1 drives and media start shipping to OEMs**

Contact Information

Find out more about Sony's AIT and SAIT data-storage systems on the Web at www.aittape.com or www.saittape.com, or by contacting Elizabeth Mousourakis, Senior Public Relations Specialist, Corporate Communications, Sony Electronics, San Jose, Calif; Phone (408) 955-5616; Fax (408) 955-5111; E-mail: elizabeth.mousourakis@am.sony.com

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