

The Redwood Project: An Overview

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StorageTek

REDWOOD™

AN OVERVIEW

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REDWOOD

- **REDWOOD IS A NEW GENERATION TAPE SUBSYSTEM NOW UNDER DEVELOPMENT AT STORAGETEK USING HELICAL SCAN TECHNOLOGY.**
- **THIS LIBRARY BASED STORAGE SUBSYSTEM IS DESIGNED FOR THE HIGH PERFORMANCE, DEEP ARCHIVAL MARKET.**

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REDWOOD SUBSYSTEM OVERVIEW

- o RedWood is the outgrowth of a series of internal strategic planning and customer advisory board meetings.
- o The RedWood Project, combined with the StorageTek Library Systems, is StorageTek's strategy in satisfying our customer requirements.
- o RedWood consists of combination of:
 - High-performance 36-track StorageTek tape subsystem
 - State-of-the-art digital video system as used in broadcast studios

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REDWOOD SUBSYSTEM OVERVIEW

- o The architecture of the RedWood tape subsystem takes best advantage of the formats and operational parameters defined for video 'D3' devices.
- o Capacity per meter of as much as 50 times more information than 3490E cartridges.
- o State-of-the-art media formulation integral factor in deck's design.

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REDWOOD SUBSYSTEMS OVERVIEW

MEDIA

- o This current generation of MP media is an ideal candidate for reliable data storage.
- o Significant improvements have been achieved in durability and stability over earlier generations.
- o The RedWood MP media along with its improved cartridge will meet or exceed 3480-class media lifetimes.
- o MP media technology will continue to benefit from extensive R & D expenditures in the commercial broadcasting sector and from work now in process within the data storage sector.

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MEDIA STANDARDS

3rd Draft

PROPOSED
AMERICAN NATIONAL STANDARD
HELICAL-SCAN DIGITAL COMPUTER TAPE CARTRIDGE
12.65 mm (0.50 in)
FOR INFORMATION INTERCHANGE

13 May 1992

(ASC X3 Project No. 850-D)

Prepared by
Technical Committee X3B5
of Accredited Standards Committee X3

Revision History

1st Draft:	X3B5/91-228	14 August 1991
1st Draft:	X3B5/91-228A	14 November 1991
2nd Draft:	X3B5/91-466	12 February 1992
3rd Draft:	X3B5/92-068	13 May 1992

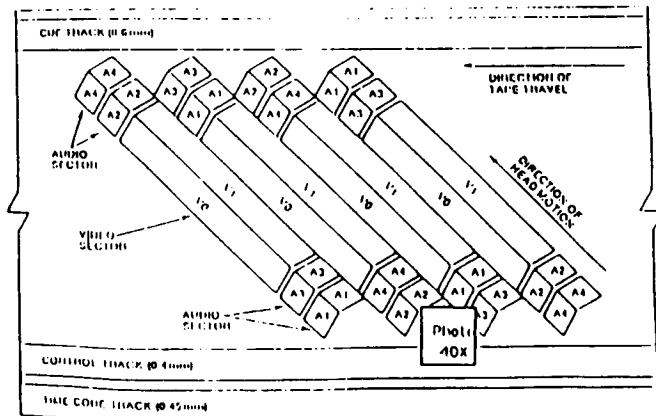
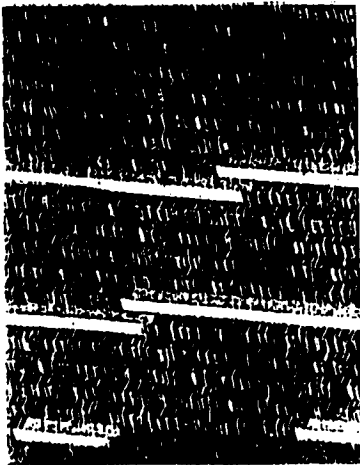
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REDWOOD DEVELOPED TAPE

- o Using a ferromagnetic fluid, the magnetic domains of a recorded tape can be viewed under magnification to show track alignment, transition spacing, defects, and data format.
- o Scale factor is 125X or about 2mm of the 12.65mm tape width is represented by this slide.
- o Bottom transitions are the longitudinal time code track, which are used for high speed searching and location verification.
- o Middle transition are servo sync pulse used to align the reel motors, capstan, and scanner motors for precise positioning of the tape.
- o Helical tracks in the upper area are written at opposing 20° azimuth angles to reduce cross talk and allow gapless recording. The tracks are written at an helix angle of 4.92° with a track spacing of $20\ \mu\text{m}$ (1270 TPI).

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D3 HELICAL RECORDING FORMAT



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REDWOOD CARTRIDGE

- o Same media as D3 with video format extended for data.
- o Storage reel only - permanent take-up reel; in drive.
- o Packaged in a 3480 form-factor cartridge.
- o Accommodates same range of tape length as 3480.
- o Meets or exceeds 3480-class media lifetimes.
- o ANSI format includes data compression.

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REDWOOD CARTRIDGE FEATURES

- o Tape pulled from opposite corner to 3480
 - Straighter path for loading arm
- o Improved leader block design over 3480
 - Field-replaceable without special tools
 - More reliable latching mechanism
- o Notch to ensure no damage if inserted into 3480 drive
- o Design ensures no damage if 3480 cartridge inserted in helical scan device

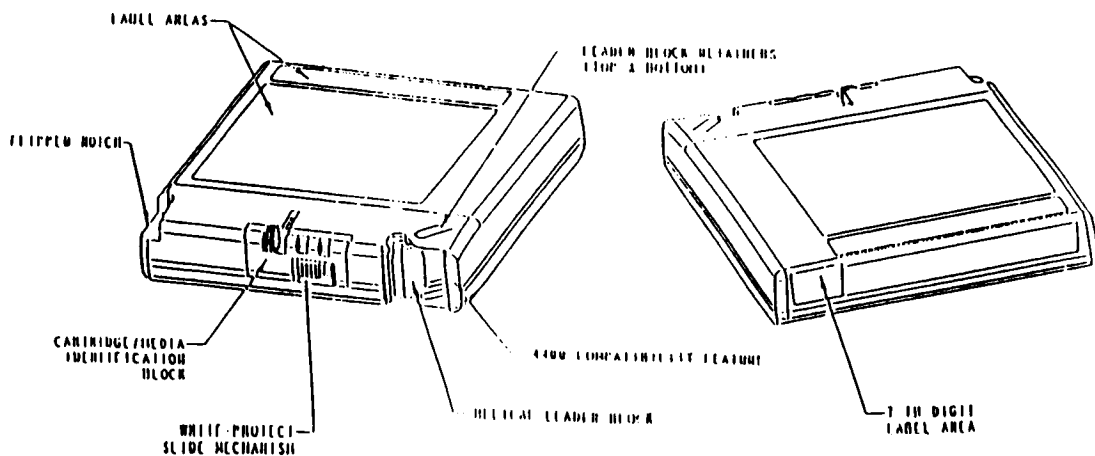
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REDWOOD CARTRIDGE FEATURES

- o Improved write-protect switch, length and machine type recognition scheme
 - Separate cartridge/media identification block for ease of manufacturing
- o Same label areas as 3480 cartridge
 - Additional area on trailing-edge

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REDWOOD CARTRIDGE



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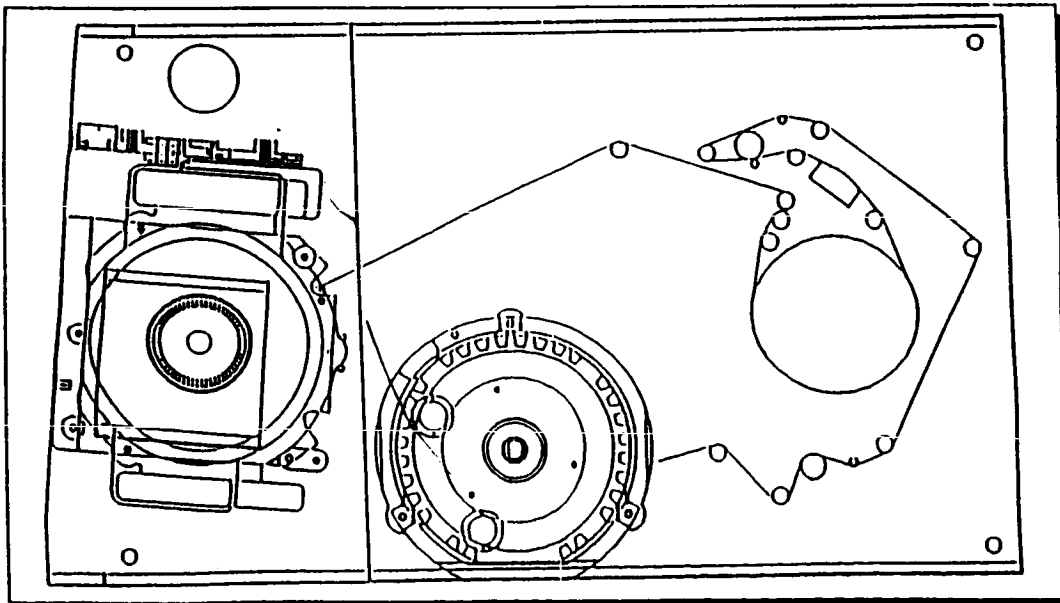
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REDWOOD SUBSYSTEM OVERVIEW

- o Head and tape wear characteristics differ from linear tape devices since the relative head-to-tape speed for RedWood is quite high, on the order of 1000 ips, in support of available data rates.
- o Life expectations for media and heads will far exceed those currently thought possible in all modes of use.
- o StorageTek has defined a means to keep track of customer tape and head usage facilitating preventive maintenance, timeliness and convenience to the customer.

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STK HELICAL DECK



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REDWOOD 1 FEATURES

- o CAPACITY PER METER OF AS MUCH AS 50 TIMES MORE INFORMATION THAN 3490E CARTRIDGES
- o DEVICE DATA RATES COMPLEMENTARY TO CAPACITY
- o 18 MB/S CHANNEL DATA RATE/ESCON
- o 10 MB/S CHANNEL DATA RATE/SCSI II
- o FIBER CHANNEL
- o BIT ERROR RATE OF 10^{-15}

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REDWOOD 1 FEATURES

- o High speed search: 60 to 100 times
 - Position of key records retained by for future searches
- o File Safe™
 - Allows tape to be written once and only once
 - Information can be appended, but existing records cannot be overwritten
 - Emulates optical Write Once Read Mostly (WORM)

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INTERFACE OVERVIEW

- o Higher device data rate requires fresh approach
 - Original ESCON announcement by IBM barely fast enough
 - Need ESCON performing at limit (approx. 18 megabytes/s)

- o Given the push towards open-systems and standards
 - New versions of SCSI (SCSI-2 fast and wide) will see use for workstation market with RedWood
 - HIPPI established in supercomputer systems, and thus is addressed in RedWood architecture
 - Fiber Channel expected to become interface of choice for medium and high-performance RedWood systems users

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HELICAL VERSUS LONGITUDINAL

- o Helical has longer mechanical latencies
 - Not a problem - uses large buffers
 - Very short records may lead to non-optimal performance and capacity utilization

- o Helical has lower inherent BER than longitudinal
 - Add 3rd Level ECC to achieve 10^{-15}
 - Both 3rd Level ECC and write retry can be disabled by system

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REDWOOD NEARLINE OVERVIEW

- o All RedWood products will operate in a library environment. The architecture also allows the customer to use stand-alone drives with or without stacker-loaders.
- o All StorageTek libraries are capable of storage and management of the new helical scan cartridge.
- o General availability features will include mixed media in the StorageTek library family (both helical and 3480 type media).

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LIBRARY COMPARISONS

LIBRARY		TIMBERWOLF	WOLFCREEK	4400/PH
Estimated Floor space (sq ft)		23	33	100
3490E (36 track)	Capacity (terabytes)	0.2	0.4	2.4
RedWood 1		10	20	120

- o Capacity comparison does not include compression
- o Floor space does not include access for manual loading, servicing

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HOST SOFTWARE FOR REDWOOD LIBRARIES

- o **IBM ARENA**
 - **MIXED MEDIA SUPPORT AT GA**

- o **OPEN SYSTEMS**
 - **CUSTOMER REQUIREMENTS WILL BE USED TO REFINE
HOST SOFTWARE AND DEVICE CONNECTIVITY FOR
EACH SPECIFIC CASE.**

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PRODUCT EMPHASIS

IBM ARENA

OPEN SYSTEMS

FEDERAL AGENCIES

MID RANGE PRODUCTS

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MARKET OPPORTUNITIES

- o Continued steep growth in capacity requirements
- o Driven by new applications
 - Imaging, seismic
 - High-definition full-color video stored digitally
 - Archives formerly on fiche, etc.
- o Only 1% of business data stored in digital form in 1990, growing to 3-5% by year 2000 (source AIM report)
 - Every company will have a true "mass storage" problem as percentage grows

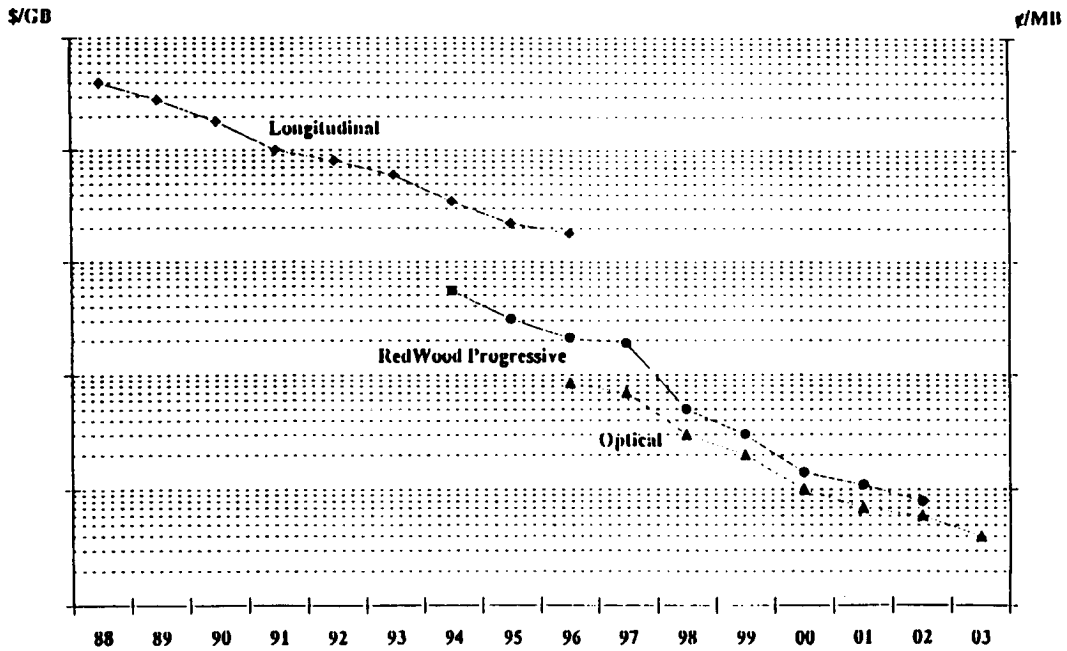
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PRODUCT AVAILABILITY

1994

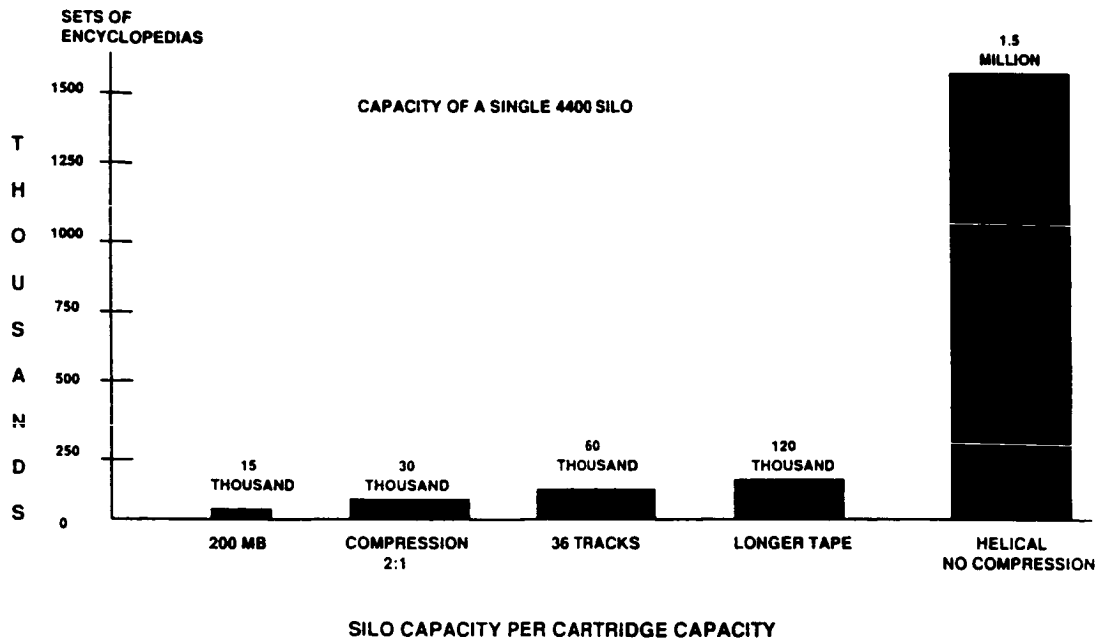
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TAPE SUBSYSTEM PRICE TRENDS



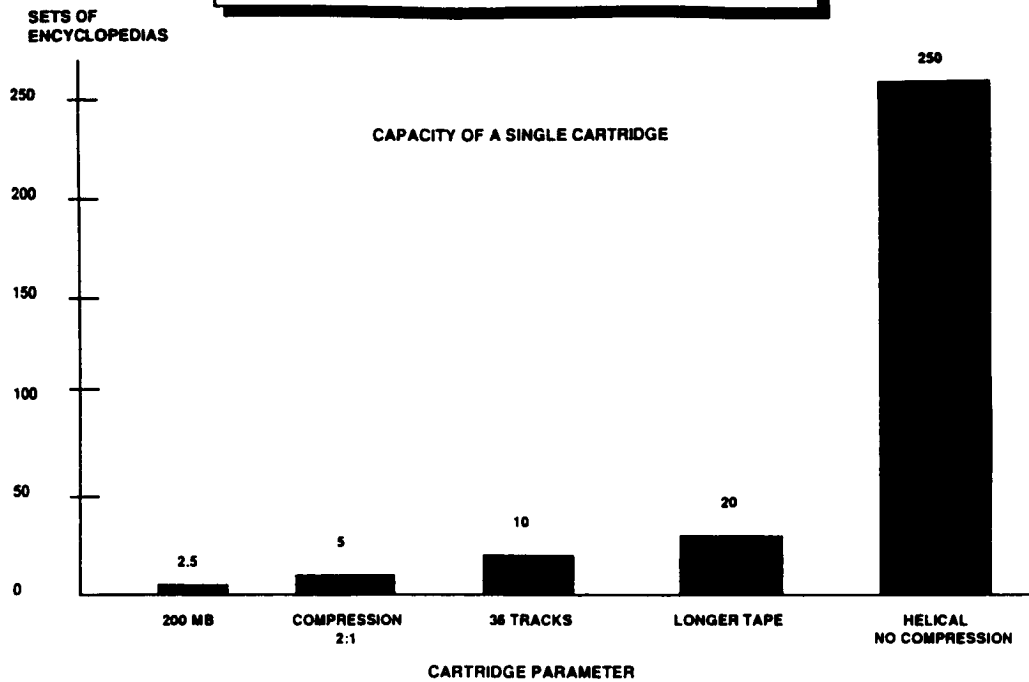
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REDWOOD POTENTIAL IN A 4400 LIBRARY IN SETS OF ENCYCLOPEDIAS



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CARTRIDGE CAPACITIES IN SETS OF ENCYCLOPEDIAS



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SUMMARY

- o RedWood allows investment in current-generation Nearline technology to be preserved in defining next-generation mass-storage systems.
- o Helical scan technology offers order-of-magnitude improvement in capacity and density, cost/GB for all Libraries.
- o Use of existing broadcast technology in RedWood significantly lowers risk.

Extensive R&D expenditures in the commercial broadcast sector will facilitate future generations of StorageTek helical-scan products

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SUMMARY

- o **Proposed standards-based helical-scan cartridge**
 - **Allows existing Nearline products to be upgraded by mixing new media with the existing cartridge set**
 - **Provides improvement in data rate over existing Nearline products in archival applications**
- o **New helical-scan features, e.g., high-speed search, File Safe will be application enablers.**
- o **RedWood facilitates use of Nearline technology in next generation mass-storage systems.**

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