



INFORMATION STORAGE INDUSTRY CONSORTIUM

International Magnetic Tape Storage Roadmap

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**Participants at the INSIC International Magnetic Tape Storage Roadmap Workshop
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INTRODUCTION

Paul D. Frank & Barry H. Schechtman, Information Storage Industry Consortium (INSIC)

This document presents a ten-year outlook for the future applications for information storage that may be handled by advanced magnetic tape storage systems, along with an in-depth analysis of the technologies that will be required to make those systems possible through 2022. It is an update to the International Magnetic Tape Storage Roadmap produced by the Information Storage Industry Consortium four years ago [1], and represents INSIC's 6th magnetic tape storage roadmap, with previous studies having been published in September 2008, April 2005, February 2002, June 1998 and September 1994, the earliest three of these roadmaps having been published as the National Storage Industry Consortium (NSIC). The view contained here of technology advances projected for future tape drives and media is a remarkable testament to the successful longevity of the oldest computer storage technology still in use today, having now reached its 60th anniversary [2].

We believe that two conclusions stand out from this Roadmap. First, although tape products in the traditional short-term data protection applications (backup and restore) continue to face increasingly tough competition, primarily from magnetic disk-based systems, there are rapidly growing applications, namely in data archiving and disaster recovery, in which tape excels in providing the most reliable, least expensive storage for huge quantities of data, high data transfer rates, the removability of encrypted data volumes to facilitate off-site safekeeping, as well as the lowest energy consumption and lowest total cost of ownership. In addition to the case study by The Clipper Group [3] detailed in the Applications and Systems section that follows, several recently published studies have continued to support this view [4, 5, 6]. Second, tape technology and products have continued to deliver on the promise of earlier INSIC roadmaps by doubling capacity and increasing data rates by 50% approximately every two years. The present roadmap calls for a continuation of these rates of progress for at least the next decade, and describes in detail the technical challenges and necessary advances required for each critical element of the technology to fulfill this goal. A message that comes through loudly, however, is that no single part of the technology can move tape storage forward based solely on its own progress. Progress against difficult challenges must be made by all the sub-technologies: transport/servo mechanisms, media, heads and channel electronics. Other established storage technologies (magnetic disk, optical disc and solid state storage), all of which potentially compete against magnetic tape in certain applications, appear to be facing technical issues associated with being close to fundamental physical limits [7]. In contrast, this study suggests that, for magnetic tape, the technical path forward appears relatively clear over the next decade.

This document represents the collective work of 75 participating experts, from industry and academia alike, representing 25 organizations worldwide. The Applications and Systems section of this study was formulated by a team of nine industry representatives, under the leadership of Barry Schechtman (INSIC), and using additional inputs from leading industry analysts. The Applications and Systems team has produced an insightful outlook for storage applications for tape systems, which was initially published by INSIC in November 2011, and has been only slightly updated for integration into this comprehensive 2012-2022 Roadmap document. The Technology section of this report is based largely on the findings of the International Magnetic Tape Technology Roadmap Workshop, which was held by INSIC on August 23-24, 2011, in Broomfield, Colorado, and which involved 50 attendees from 22

companies and universities worldwide. Four technology teams were coordinated by Robert Raymond (Oracle), and covered the outlook for transport mechanisms, media, heads and channel electronics; these technology teams were led, respectively, by Paul Poorman (Hewlett-Packard), Larry Olson (Imation), Larry Neumann (Quantum) and Evangelos Eleftheriou (IBM). In addition, Bob Biskeborn (IBM) made a major leadership contribution to the section on Tape Head Technology that appears in this document by volunteering to consolidate the results of the discussion for that team and by serving as the primary author for that section.

INSIC gratefully acknowledges the leadership contributions of all of these individuals, without whom this document would not have been possible, as well as the contributions of all of the roadmap study participants, whose names appear in the “List of Roadmap Participants” above. We believe that, thanks to the contributions of these experts, the report is balanced and credible, and that it delivers an optimistic outlook for tape storage going forward – or, as one speaker at the Technology Roadmap Workshop succinctly put it: “The future for tape is brighter than it’s been for a long time.” However, we also believe that this optimistic outlook will be fulfilled only if the tape storage industry continues to invest collaboratively in research and advanced development to provide the future technologies that are needed.

We hope you find INSIC’s 2012-2022 International Magnetic Tape Storage Roadmap that follows to be both enlightening and worthwhile.

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