SPC BENCHMARK 1C™
EXECUTIVE SUMMARY

SEAGATE TECHNOLOGY LLC *(TEST SPONSOR)*
HITACHI ULTRASTAR A7K1000

SPC-1C™ V1.1

Submitted for Review: October 15, 2008
Submission Identifier: C00003

EXECUTIVE SUMMARY

Test Sponsor and Contact Information

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Auditor	Storage Performance Council – http://www.storageperformance.org Walter E. Baker – AuditService@StoragePerformance.org 643 Bair Island Road, Suite 103 Redwood City, CA 94063 Phone: (650) 556-9384 FAX: (650) 556-9385

Revision Information and Key Dates

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SPC-1C Specification revision number	V1.1
SPC-1C Workload Generator revision number	V1.0
Date Results were first used publicly	October 15, 2008
Date the FDR was submitted to the SPC	October 15, 2008
Date the TSC is available for shipment to customers	currently available
Date the TSC completed audit certification	October 1, 2008

Tested Storage Product (TSP) Description

The Ultrastar™ A7K1000 delivers up to one terabyte of storage capacity in a standard 3.5-inch form factor, filling a vital need for high-density storage in the enterprise. As the third generation design, based on the popular Deskstar™ E7K500, the Ultrastar A7K1000 continues to set the standard in enterprise-class reliability and performance for enterprise and nearline applications requiring high-capacity storage. With a unique 5-platter design, Hitachi has relaxed the bit densities to achieve higher reliability. The Ultrastar A7K1000 is built using the industry's most reliable perpendicular magnetic recording (PMR) recording heads and media.

Summary of Results

SPC-1C Results	
Tested Storage Product: Hitachi Ultrastar A7K1000	
Metric	**Reported Result**
SPC-1C IOPS™	133.95
Total ASU Capacity	500.103 GB
Data Protection Level	Unprotected
Total Price – Priced Storage Configuration	$527.89

SPC-1C IOPS™ represents the maximum I/O Request Throughput at the 100% load point.

Total ASU (Application Storage Unit) **Capacity** represents the total storage capacity read and written in the course of executing the SPC-1C benchmark.

A **Data Protection Level** of "Unprotected" makes no claim of data protection in the event of a single point of failure.
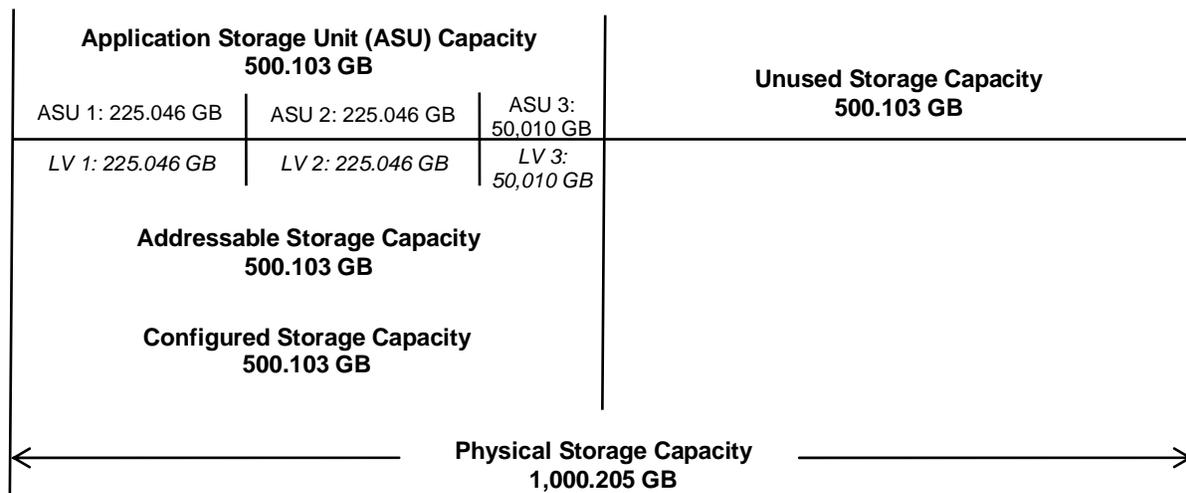
Storage Capacities and Relationships

The Tested Storage Configuration (TSC) must be configured so that there is either no Unused Storage or that the sum of Total ASU Capacity and storage required for data protection equals 50% (+-1 GiB) of the Physical Storage Capacity. This configuration meets the 50% requirement as documented below:

> **1,000.205 GB** *(Physical Storage Capacity)* *** 0.5 = 500.102 GB**
>
> **500.103 GB** *(Total ASU Capacity)* **+ 0.000 GB** *(data protection)* **= 500.103 GB**

The following diagram documents the various storage capacities, used in this benchmark, and their relationships.

Application Storage Unit (ASU) Capacity 500.103 GB			Unused Storage Capacity 500.103 GB
ASU 1: 225.046 GB	ASU 2: 225.046 GB	ASU 3: 50,010 GB	
LV 1: 225.046 GB	*LV 2: 225.046 GB*	*LV 3: 50,010 GB*	

Addressable Storage Capacity
500.103 GB

Configured Storage Capacity
500.103 GB

←——————————————— **Physical Storage Capacity** ———————————————→
1,000.205 GB

Response Time – Throughput Curve

The Response Time-Throughput Curve illustrates the Average Response Time (milliseconds) and I/O Request Throughput at 100%, 95%, 90%, 80%, 50%, and 10% of the workload level used to generate the SPC-1 IOPS™ metric.

The Average Response Time measured at the any of the above load points cannot exceed 30 milliseconds or the benchmark measurement is invalid.
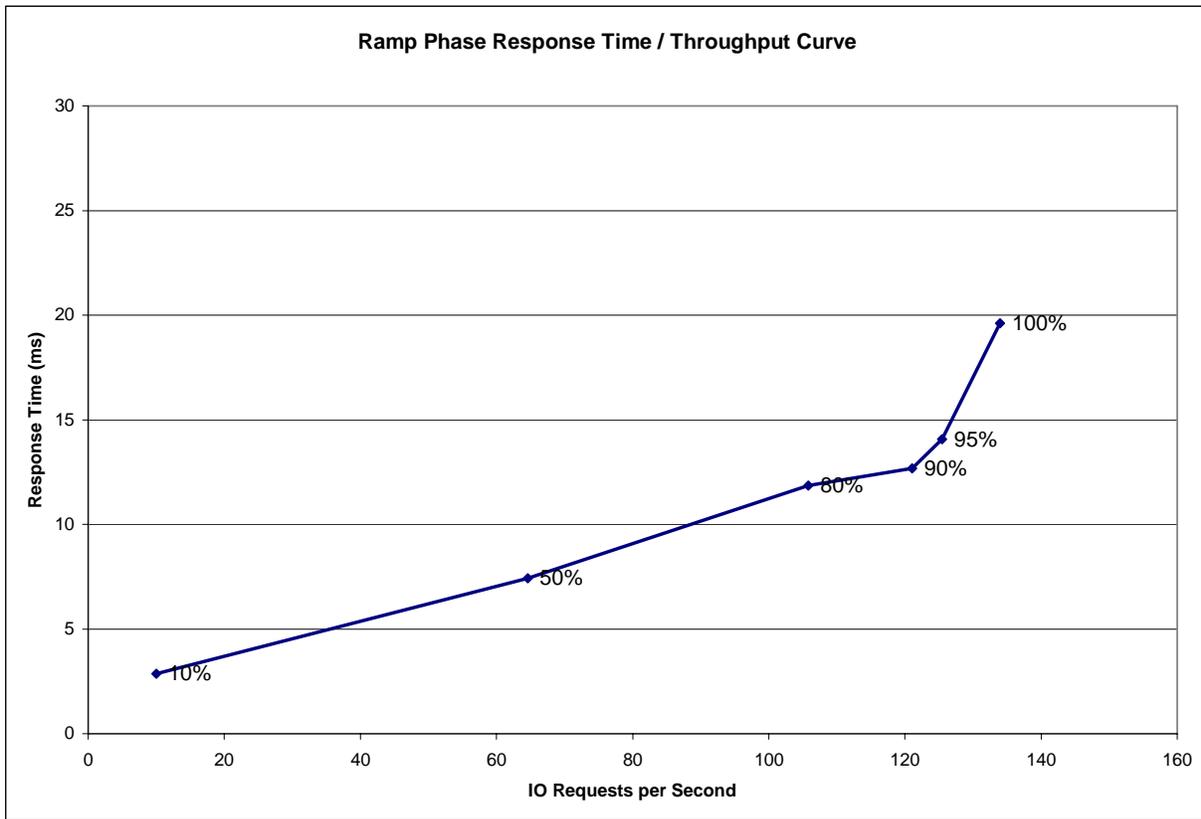
Response Time – Throughput Data

	10% Load	50% Load	80% Load	90% Load	95% Load	100% Load
I/O Request Throughput	10.00	64.57	105.80	121.06	125.47	133.95
Average Response Time (ms):						
All ASUs	2.86	7.43	11.86	12.69	14.06	19.61
ASU-1	4.05	9.23	13.53	14.20	15.41	20.90
ASU-2	3.35	9.14	13.83	14.23	16.25	21.55
ASU-3	0.32	2.92	7.53	8.79	10.29	16.07
Reads	6.97	14.16	18.88	19.42	20.74	26.75
Writes	0.28	3.01	7.23	8.29	9.71	14.98

Tested Storage Configuration Pricing *(Priced Storage Configuration)*

Description	Part Numbers	Qty	Price	Extended Price
1TB GB SATA 3.5" HDD	HUA72101	1	314.81	314.81
SAS HBA	LSI00033-F	1	213.08	213.08
(incl 4 SAS/SATA -1M Cables)				
			Total	**$527.89**

Differences between the Tested Storage Configuration (TSC) and Priced Storage Configuration

There were no differences between the Tested Storage Configuration and the Priced Storage Configuration.

Benchmark Configuration/Tested Storage Configuration Diagram

Windows 2003
"White Box" Host System

LSI SAS3041X-R HBA

point-to-point
cable connection

Hitachi Ultrastar A7K1000
SATA disk drive

Benchmark Configuration/Tested Storage Configuration Components

Host System:	Tested Storage Configuration (TSC):
HS-1	1 – LSI SAS3041X-R HBA

"White Box" Host System:
   Supermicro X6DH*-XG2 motherboard
   2 – 2.8 GHz Intel® Xeon™ CPUs
   16 KB L1 cache per CPU
   1024 KB L2 cache per CPU
   2 GB main memory
	1 – Hitachi Ultrastar A7K1000 SATA disk drive

	1 – Point-to-point cable connection
Windows 2003 Enterprise Edition	
PCIe	