Run II SMWG Status Report

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Where we left off:

- **General purpose robot allows any viable tape product**
- **Waiting out the marketplace for next generation technologies**
- **Focussed on commodity options with good roadmaps:**

  SONY AIT:
  AIT-1 25GB 3MB/s
  AIT-2 50GB 6MB/s $3500 drive, $100 tape ?

  EXABYTE Mammoth
  Mammoth-1 20GB 3MB/s
  Mammoth-2 60GB 12MB/s $5,000 drive, $100 tape

  Quantum DLT

Recent Activities

1/19/99 Quantun DLT Site visit
Trip report by M. Diesburg

1/20/99 Writeups of previous round of tests of DLT, Mammoth-1, AIT-1. (S. Lammel)

2/17/99 Begin program of tape drive tests with Mammoth-1, AIT-1, and DLT on EMASS AML. K. Genser supervising.

2/23/99 Exabyte Site visit (DA,SL,MD,KG)
Agree to exchange technical information
Trip report by M. Diesburg

3/5/99 List of performance and reliability questions sent to Exabyte (re Mammoth-2) and Sony (re AIT-2)

3/12/99 Exabyte team @ FNAL, inc Jorgen Frandsen, Dir. Eng.
Exabyte proposes evaluation units in mid-July

3/31/99 Receive replies to questions from Exabyte

4/14/99 First report from EMASS test program

4/21/99 Exabyte transmits Mammoth-2 product schedule (non-disclosure)

5/5/99 Final report from EMASS test program
Reappraisal of Ampex option (L. Lueking)
"Sense of committee"

5/11/99 New contact with Sony sales Rep, offer to expedite information exchangeon AIT-2
Initiate P.O. for 3 AIT-2

5/17/99 Exabyte schedule Mammoth-2 test units to FNAL mid-June

6/1/99 AIT-2 briefly visits, quick test

SUMMARY OF RECENT SMWG TAPE DRIVE TESTS (K. Genser)

There was another SMWG set of tests done between mid February and beginning of May of 1999. Five tape drives and 125 tapes underwent a life test to evaluate their longevity, and reliability. The tests were done by a consultant Joel Hinrichs who was supervised by Krzysztof Genser.

The tests were performed using EMASS/ADIC AML/2 tape library (robot)
and a dual 400 MHz Pentium II PC running Red Hat Linux release 5.0 Kernel 2.2.6 using a single Adaptec AHA-2944 ultra, wide, differential SCSI card with all five drives connected to it.

Fermilab FTT package version 2_3 with some dedicated modifications related to the new drives to be incorporated in FTT version 2_4 was used to control the drives as well as the Linux mt command.

Drives which were tested

- **Exabyte Mammoth drive #1**
- **Quantum DLT drive #1**
- **Quantum DLT drive #2**
- **Sony AIT drive #1**
- **Sony AIT drive #2**

The drives were subjected to sets of operations which consisted mainly of

- **mount/dismounts (MD)**
- **mount/skip/read/rewind/dismounts (MSRRD)**
- **mount/skip/read/backspace/write/rewind/dismounts (MSRBWRD)**
- **mount/write/rewind/dismounts (MWRD)**

The file sizes were mainly 32 and 512MB. The record size was 48kBytes. The data was generated using a random number generator.

During the test the following number of operations described above were performed shown together with the initial mount count:

	Init(MD)	MD	MSRBWRD	MSRRD	MWRD	Total
Mammoth	**2991**	**12761**	**701**	**4263**	**84**	**20800**
DLT #1	**2319**	**813**	**6319**	**2148**	**172**	**11843**
DLT #2	**1341**	**7741**	**0**	**4**	**62**	**9148**
AIT #1	**4292**	**5563**	**0**	**4699**	**115**	**14669**
AIT #2	**5189**	**1895**	**5848**	**5457**	**356**	**18745**

CONCLUSIONS (K. Genser)

The drive Quantum DLT #1 failed the test after 11843 mounts with a tape permanently stuck in it.

After about mount number 12019 drive AIT #1 started to show a number of hard/soft write errors and rarely hard read errors which had caused unpredictable drive behavior resulting in writing incomplete files and very significant degradation of the tape capacity.

Exabyte Mammoth #1, Sony AIT #2, Quantum DLT #1 survived 20800, 18745 and 11843 mounts respectively (this is when the tests were stopped).

Reliability of all the drive types was signifficantly better than the reliability of the Exabyte 8200 and 8500 drives used in Run I. (Compare to 450 RW passes with 8500)

Together with the tests done within SMWG by Stephan Lammel in 1998 one can conclude that as of now the most promising drives are Exabyte Mammoths which performed well in both tests.

Issues and Facts at this Point

1. DLT: unreliable in first round

some confirmation of this in second round

site visit suggests not even demo models till fall

This technology is disfavored

2. SONY AIT:

AIT-1 25GB 3MB/s

AIT-2 50GB 6MB/s $3500 drive, $100 tape ?

some unresolved issues from the first round

- **bad batch of media was never acknowledged**
- **drive does not recognize it is dirty**
- **could not make partitioning work**

some similar concerns second round

- **drive fails as if dirty, but light not on**

but mostly:

- **uncertainty about AIT-2 media availability**
  - **AME on kevlar substrate**
  - **one supplier, unhappy relationship with SONY**
- **vendors shipping just 1-2 media per drive**
  only 170m (=35GB), no 230m before Fall

3. EXABYTE:

Mammoth-1 20GB 3MB/s

Mammoth-2 60GB 12MB/s $5,000 drive, $100 tape

very good interactions with company

problems identified in round 1 testing fixed

good performance in round 2, and no inconsistency found with any technical info supplied by Exabyte

disappointing performance with promised dates for test units

however, seem on track w/rspct to internal schedule

Sense of the Committee:

Mammoth-1 has performed acceptably in our tests, and Mammoth-2 looks promising. Mammoth-1 is back compatible with Run I tapes, and would be an acceptable starting point, with forward compatibility of new tapes to Mammoth-2.

The Committee feels that Exabyte Mammoth is the best candidate at this time.

However, we still have a window this summer for testing both Mammoth-2 and AIT-2, and we will.

We would like to make a decision that would allow us to have of order 10 drives installed for each experiment by ca. September…

n.b. a decision for Exabyte would make us first customer for EMASS/ADIC supporting Mammoth…

Re-evaluation of a Data Center Option (L. Lueking)

Table I. Drive streaming throughput, media and AML2 capacities. Numbers in () are for the Mammoth 230m tapes.

	AMPEX(small)	Ampex(med)	Mammoth I	Mammoth II
Drive (MBps)	20	20	3	12
Media capacity (GB)	93	279	18	60 (230 m)
AML2 tower slots	2200	1152	5185	5185
AML2 tower capacity (TB)	204	321	93	228 (311)

Table II. Quantity, unit price, and total costs for drives to support 200 MBps (streaming) and media to store 1PB of data. Numbers in () are for the Mammoth II 230m tapes.

	AMPEX			Mammoth I			Mammoth II		
	Number	@	Total	Number	@	Total	Number	@	Total
Drive 200 MBps	10	100k	1,000k	70	2.5k	175k	20	4k	80k
Media 1 PB	3584	250	896k	55,555	80	4.45M	22,727 (16,666)	80 80	1,818 (1,333)
Total			1,896k			$4,625k			$1,898k ($1,413k)

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