M-Systems
Flash Disk Pioneers

Mechanical Hard Drive vs. FFD Solid-State Drive

Technical Note, April 2005
Guy Freikorn (guy.freikorn@m-systems.com)

1. INTRODUCTION

1.1 Overview

This document compares the characteristics of a mechanical hard disk drive (HDD) based on magnetic media with FFD, a solid-state drive based on flash media.

1.2 Mechanical HDD

HDDs are relatively inexpensive and provide high-capacity data storage. Nevertheless, the HDD's magnetic media and rotating mechanism are sensitive to harsh environmental conditions and physical orientation and may fail, causing partial and sometimes even total data loss in mission-critical applications. Exposure to high shock, vibration, altitude, or extreme temperatures boosts the hard-drive failure rate (in percentage) to double digits, which is unacceptable for mission-critical systems.

1.3 FFD

FFD is a solid-state disk with no moving parts. Like an HDD, the FFD offers high-capacity data storage and retains data when its power source is off or disconnected. In addition, unlike an HDD, the FFD's flash media is unaffected by either physical orientation or harsh environmental conditions, and doesn't suffer from an increased failure rate when exposed to high shock, vibration, altitude, or extreme temperatures.

2. COMPARING HDD AND FFD

Table 1 compares the characteristics of HDD and FFD.

Table 1: Analysis of HDD and FFD

Category		HDD	FFD
Environmental Specifications	Operating temperature range	+5°C to +55°C	-40°C to +85°C
	Non-Operating temperature range	-40°C to +70°C	-55°C to +95°C
	Operating shock	20 G–125 G	1500 G
	Operating vibration	1 G (22-500 Hz)	16 G (20–2000 Hz)
	Humidity	5%–90%	5%–95%
	Operating altitude	15,000 ft	80,000 ft
	Acoustics, idle/ready	2.9 (Bels)	0
Environmental Standards	MIL-STD-810	Non-compliant	Fully compliant
	NEBS: GR-63-CORE, and GR-1089-CORE	Non-compliant	Compliant to NEBS Level 3
Reliability	Actual/Fielded MTBF	<70,000 operating hrs	>700,000 operating hrs
Endurance	Write/Erase cycles	N/A	>5 million (>10 years of constant write operation)
Performance	Average seek	3.0–5.0 msec	0.02–0.5 msec
	Average latency	2.0–5.0 msec	NA
	Sustained read rate	30.0–55.0 MB/s	8.0–45.0 MB/s
	Sustained write rate	20.0–45.0 MB/s	8.0–40.0 MB/s
Power	Power idle	0.8–5.0 W	0.035–3.0 W
	Power read/write	5.0–10.0 W	0.325–5.0 W
Security	Delete data under emergency conditions (without retrieving the data)	Non-compliant. Must degauss or physically destroy the drive.	Sanitize feature complies with DoD NISPOM 5220.22-M, NSA 130-2, Air Force AFSSI 5020, Army 380-19, Navy NAVSO P-5239-26 and IREC (IRIG) 106, and other standards
Capacity	3.5" form-factor	40GB–500GB	128MB–176GB
	2.5" form-factor	40GB–80GB	128MB–128GB
Cost	Procurement	$70–$400	<$250/GB

3. SUMMARY

FFD provides true drop in replacement for HDD. FFD has identical physical dimensions for 2.5” and 3.5” form factors, the same mounting holes, and the same interfaces.

In mission-critical applications where reliability, fast boot time and ruggedness are crucial requirements, FFD replaces HDD as the data storage component of choice.

HOW TO CONTACT US

USA

M-Systems, Inc.
555 North Mathilda Avenue, Suite 220
Sunnyvale, CA 94085
Phone: +1-408-470-4440
Fax: +1-408-470-4470

China

M-Systems China Ltd.
Room 121-122
Bldg. 2, International Commerce & Exhibition Ctr.
Hong Hua Rd.
Futian Free Trade Zone
Shenzhen, China
Phone: +86-755-8348-5218
Fax: +86-755-8348-5418

Japan

M-Systems Japan Inc.
Asahi Seimei Gotanda Bldg., 3F
5-25-16 Higashi-Gotanda
Shinagawa-ku Tokyo, 141-0022
Phone: +81-3-5423-8101
Fax: +81-3-5423-8102

Europe

M-Systems Ltd.
7 Atir Yeda St.
Kfar Saba 44425, Israel
Tel: +972-9-764-5000
Fax: +972-3-548-8666

Taiwan

M-Systems Asia Ltd.
14 F, No. 6, Sec. 3
Minquan East Road
Taipei, Taiwan, 104
Tel: +886-2-2515-2522
Fax: +886-2-2515-2295

Internet

www.m-systems.com

General Information

info@m-systems.com

Sales and Technical Information

techsupport@m-systems.com