WINCHESTERSYSTEMS®

Purpose-Built Storage

FlashDisk™ All Flash Array (AFA)
Media and Entertainment Solutions Guide

This document, focused on media editing, describes design models of Media Storage Solutions and typical Service Solutions to highlight the unique characteristics of the FlashDisk All Flash Array from Winchester Systems and customer benefits it offers.

Contents

What is Media & Entertainment?

In the media asset industry, companies can be categorized into video production, TV stations and network streams. Video production services include most advertising productions, film post-processing and animation productions such as Pinewood or Time Warner. TV stations contain local or nationwide TV stations such as Public Broadcasting System (PBS), American Broadcasting Company (ABC), etc. Network streams are a new media category usually used in network television, VOD and social streaming sites such as Facebook and YouTube.

In the following section, we will introduce how media workflows are used in M&E industries.

Media Service System Overview
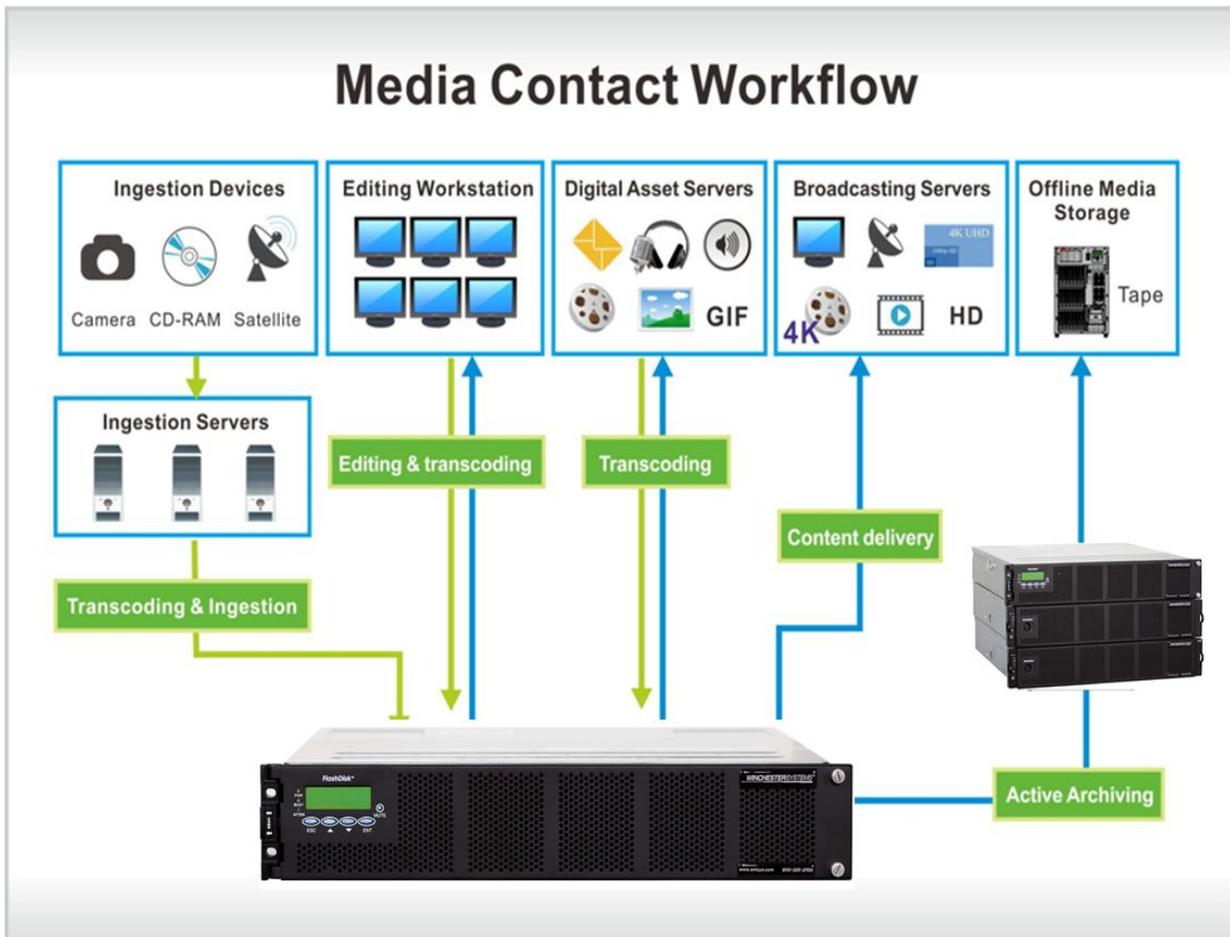
Figure 1 Media service system and workflow

Ingest

The ingestion process involves everything from image capture to ingesting videos to local computers via upper-layer software programs and finally migrating those materials into a storage system. Ingest performance may vary depending on upper-layer software behavior and video type. Video ingestion types have changed from a single channel of standard definition (SD) to multiple channels of high definition (HD), ultra-high definition (UHD) and even 4K streams, requiring increasingly more storage write-bandwidth and reliability. Winchester Systems storage solutions' support the high write-performance required to ingest these streams, not only saving processing time, but also giving customers more time for their editing and creative processing.

Edit/Composite

Currently, non-linear editing is more popular than traditional tape editing. The FlashDisk AFA is compatible with most major third-party editing software programs, allowing you to edit and design with stable performance. The FlashDisk AFA provides a smooth video ingest in multiple high-resolution streams with no single point of failure. Furthermore, FlashDisk AFA storage is architected to provide the scalability to ensure all your video materials can be stored and retrieved even as your storage capacity requirements change.

Render/Transcode

Whether you are transcoding clips to multiple formats or rendering images, high-performance, low-latency storage is key to all processes. FlashDisk AFA delivers excellent performance to meet the needs of critical IOPS-intensive and latency-sensitive operations.

Digital Asset

Digital asset storage must provide a huge capacity to save massive videos, image and sound files for a long time, while allowing those media assets to be accessed frequently and efficiently. In TV stations, we call digital asset storage a MAM service system. The FlashDisk AFA helps users to digitally store a variety of media materials with flexible and scalable expansion enclosures to satisfy the demands of different editing groups.

Content Delivery

With increasing demand for cost-efficient high-resolution content, many editing groups are looking for a critical system to support the massive uptake in users of multi-stream delivery services, such as studio broadcasting and

master control broadcasting. Media workload in video production mainly generates sequential read access patterns with some random read I/O blocks. With multiple data-intensive audio and video playback, throughput and latency are key performance evaluation indicators and critical components of successful distribution by traditional broadcast, satellite, Internet video or social media. FlashDisk AFA effectively supports multiple feed streaming and high-quality media playback with the best price performance in the market.

Active Archive

To help you produce all facets of creative media, FlashDisk AFA storage systems deliver high-bandwidth and stable performance, maintaining your workflow and allowing you to access historical content fast, unlike traditional tape storage. With flexible and scalable capacity, active archives are deployed using cost-effective expansions to store huge media data.

Regardless of whether editing groups focus on all or just some of these six media workflows, the FlashDisk AFA provides the performance, capacity and reliability to fit the demands from any type of media and ensure your workflows run smoothly and safely.

FlashDisk AFA M&E Solution

Solution Design Principles

- Ingest – High sequential write performance
- Edit/Composite – Fast write and I/O with scalable capacity
- Render/Transcode – Excellent random I/O performance
- Digital asset – Scalable capacity and high reliability
- Content delivery – Extreme read performance and scalable capacity
- Active archive – Long-term storage capacity and fast access for content

Figure 2 Media workflow demands

Video Production Storage Solution

Scenarios

The following diagram shows the standard video production workflow:
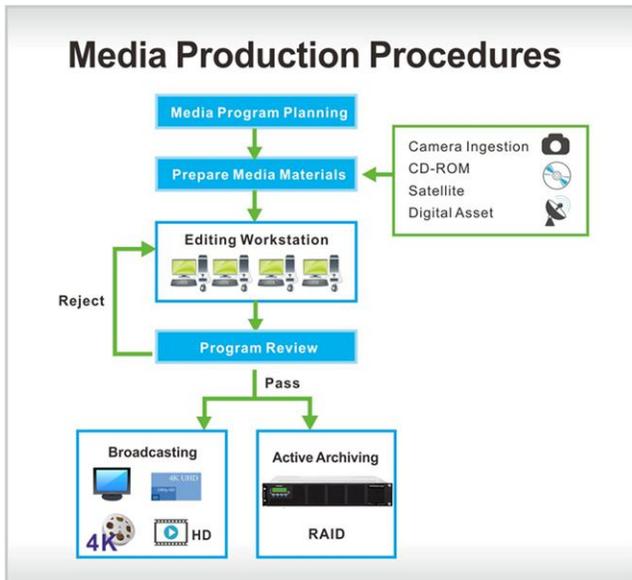
Figure 3 Normal media production procedures

Once media is ingested via cameras, CD-ROMs or satellites and saved into local servers, media groups can edit and render those materials as digital assets or in different video formats, after which the finished file is broadcasted and archived. **FlashDisk AFA M&E storage solutions facilitate media production procedures from uploading, downloading and video editing, to audio processing, media rendering, content delivering and active archiving.**

In the video production process, storage systems face four key challenges:

Excellent Storage Performance for Improved Efficiency

Storage performance throughput must support multiple streams in editing and simultaneous delivery. Video format resolutions, frames per second and compression rate will lead to different demands of bandwidth. See Table 1 for some common resolutions and throughput requirements.

FlashDisk AFA can be configured for all kinds of media operations, from corporate media and studio broadcasting to 4K post-production and master control broadcasting services. Since media data contains a variety of video stream services formed by huge data blocks, high throughput is a must. Moreover, when it comes to continuous video recording and playback, low latency and stable throughput ensure frames aren't lost or the video freezes. FlashDisk AFA offers excellent performance with stability and low latency.

Resolution	FPS	Compression	Video Throughput (MB/s)
(4K) 4096 x 2160	24fps (cinema)	Uncompressed RGB 10-bit	849.4
		BluRay H.264	28.7
		ProRes 422	113.0
	20fps (low end video)	Uncompressed RGB 10-bit	706.0
		BluRay H.264	23.9
		ProRes 422	93.9
(2K) 2048 x 1536	24fps (cinema)	Uncompressed RGB 10-bit	306.0
		BluRay H.264	10.2
		ProRes 422	40.0
	20fps (low end video)	Uncompressed RGB 10-bit	255.0
		BluRay H.264	8.5
		ProRes 422	33.4

Table 1: Example of 4K and 2K stream throughput demands to different video formats

Flexible Storage Capacity for Improved Media Workflow

To fit the needs of a wide range of editing groups, FlashDisk AFA enclosures support a variety of SSDs model ranging from models tailored for the highest performance and endurance to those optimized for cost and capacity. By using 12Gb/s SAS technology, the FlashDisk AFA boosts throughput and doubles the performance over designs using 6Gb/s SAS.

Compatibility with third-party file sharing systems and Video Editing Software

In SAN storage based architectures, additional file sharing products, such as Xsan, StorNext, Sanergy, are needed to ensure all editing groups can access media materials simultaneously. Compatibility with media editing software, such as Apple Final Cut Pro and Adobe Creative Cloud, is important to support non-linear editing and heavy stream processing. The FlashDisk AFA is compatible with all of these products.

Reliability and Green Design

To ensure continuous access to media assets, utilizing a storage device designed to offer high availability is critical in media processing. Saving power and cooling is another key criteria in designing an optimal storage solution. Some of the key reliability and power saving attributes provided by the FlashDisk AFA are:

- Redundant core components (Controllers, PSUs, Fans) for data protection and availability
- SuperCap Cache Backup Technology for guaranteeing no data loss during power failures
- 99.9999% availability
- Redundant 80 PLUS power supplies
- Intelligent drive and fan spin-down

Solutions

I.   FlashDisk AFA Storage Structure

Currently, typical storage solutions use FC SAN architectures, which provide block-level storage. The diagram below shows FC SAN network architectures.

Figure 4 SAN storage architecture

II. Solution Architecture

FlashDisk AFA - Best for High Bandwidth Storage Requirements

The FlashDisk AFA features 16Gb/s Fibre Channel connectivity. It is the ideal high power multimedia storage solution, offering consistent throughput as well as flexible and highly scalable capacity. It supports multiple simultaneous 4K media streams, allowing editors to perform their tasks without delays. When extra storage capacity is needed, the FlashDisk AFA can be expanded online, without interrupting active processing, to up to 72 SSD's, through additional high density JBODs. This makes the FlashDisk AFA the leading solution for the Media & Entertainment industry.

Figure 5 FlashDisk AFA series

- **Storage system: FlashDisk AFA series with RAID5 configuration**
- **Compatible third-party filesystems: Xsan, StorNext, Sanergy, metaSAN, etc**
- **Expansion Options: 2U 24 bay 12Gb/s SAS JBODs**
- **Drive Types: 12Gb/s SSD's of varying capacity and endurance ratings**
- **Host Connectivity and Network layer: 8 Gb or 16 Gb Fibre Channel or 10 Gb iSCSI**

III. Video Stream Performance Optimization Function: AV Optimization

Winchester Systems FlashDisk Global Manager reduces the effort required to manage and monitor the storage system with its clear dashboard and event log. Customers can not only configure their array to create volumes, host mappings and enable data services, but also focus on M&E solutions, with optimized stream performance, ensuring all members of the media group receive the best editing experience possible.

__AV optimization__ in the FlashDisk AFA family is a media editing function with two major parameters: read-ahead and maximum drive response time. Read-ahead automatically detects multiple sequential and big block I/O behaviors, prompting the firmware to cache that essential eight stripe media data beforehand, providing a stable high throughput without frame drop. Suitable maximum drive response time ensures every drive responds to each I/O request immediately. If one RAID 5 drive experiences delays in its I/O response time, the read-ahead feature will read parities in cache, allowing the storage system to use parities to compute the needed data

instead of waiting for the delayed I/O to provide a smooth video streaming in any ingestion or production.

AV Optimization Mode:	Fewer Streaming ▾

Figure 7 "AV Optimization" function in FlashDisk Global Manager

Fewer Streaming: Editing streams including 4K, 2K, UHD, HD and SD video resolutions.

Multiple Streaming: Editing streams including VOD and MOD stream type

Video Format	Read Throughput Improvement (%)
(4K) 4096 x 2160 10-bit RGB 24 fps	28%-34%
(4K) 3840 x 2160 10-bit RGB 24 fps	52%-60%
(2K) 2048 x 1556 10-bit RGB 24 fps	48%-54%
(HD) 1280 x 720 10-bit 24 fps	55%-66%

* The performance improvement percentages shown are only guaranteed in specific configurations with AJA benchmark tool
** Tested with FlashDisk AFA series

Table 2 Throughput improvement with AV optimization function.

IV.   FlashDisk AFA Highlights

High Performance

	FlashDisk AFA Series
Seq. Read Throughput	12,600 MB/Sec
Seq. Write Throughput	5,200 MB/Sec
Random IOPS	490K
# of 4K Video Streams	8

Scalable Capacity

	FlashDisk AFA Series
Form Factor	RAID: 2U24 JBOD: 2U24 (up to two)
Max. SSD Number	72

Connectivity

	FlashDisk AFA Series
Drive Side Connectivity	12Gb/s SAS
Host Side Connectivity	Up to 16 Host Ports - 8 Gb or 16 Gb Fibre Channel - 10 Gb Ethernet iSCSI 4 Ports Built-in: - 1 Gb Ethernet iSCSI

Reliability in Data Security

	FlashDisk AFA Series
High availability	99.9999%
Redundant Component	Redundant core components (controllers, power supplies, and fans) will ensure high availability with no single-point failure.
Data Services	Local snapshot and remote replication features ensure media data is safely stored in local or spare storage.

Video Stream Test with FlashDisk AFA

Configuration

With media content workflows in mind, Winchester Systems carried out a real stream test with the FlashDisk AFA based on the following configuration:

FlashDisk AFA Stream Test Configuration
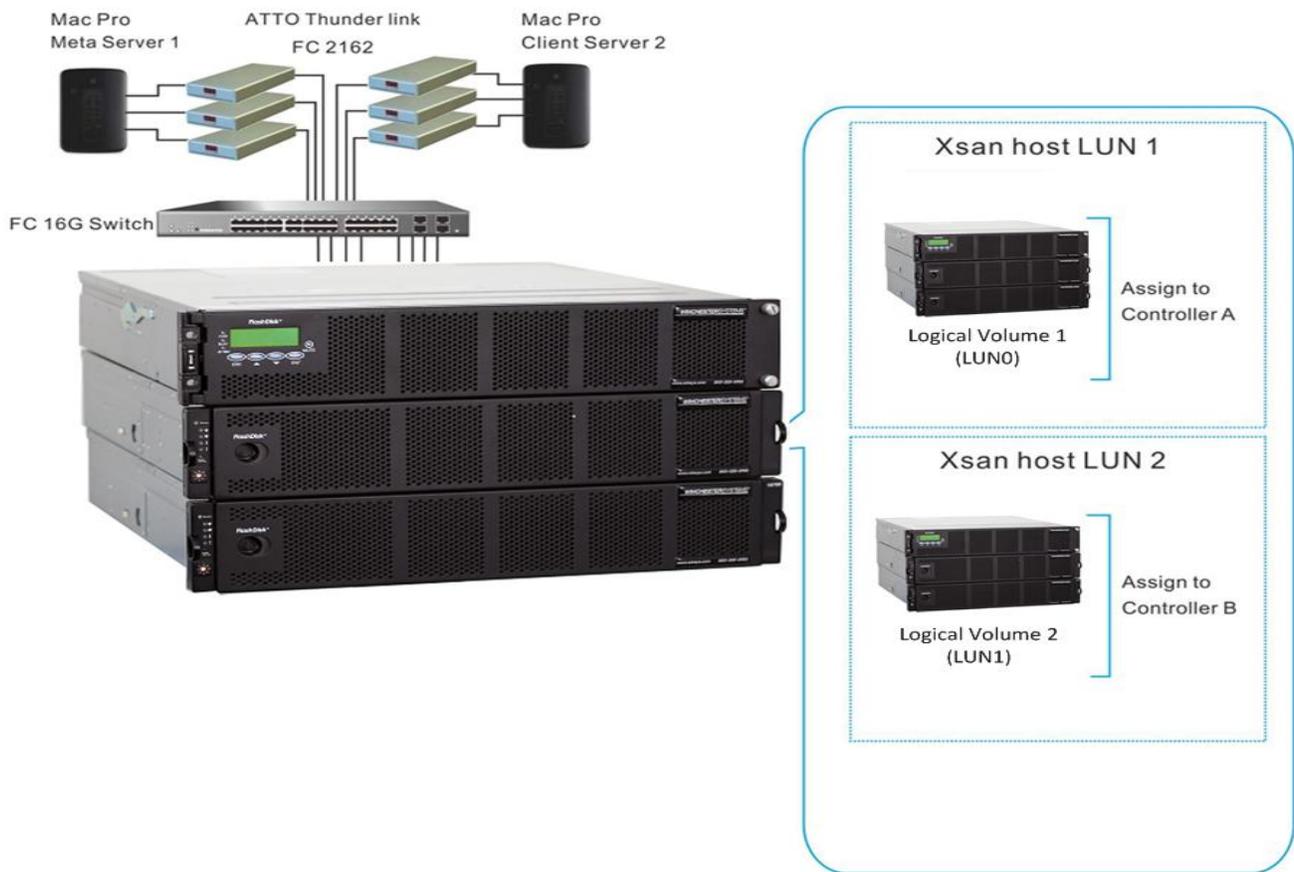
Figure 8 Configuration of FlashDisk AFA stream performance test

FlashDisk Global Manager Setting

Fewer Streaming: Editing streams including 4K, 2K, UHD, HD and SD video resolutions.
Multiple Streaming: Editing streams including VOD and MOD stream type

AJA Benchmark Tool

The AJA disk benchmark is a common benchmark for the video industry that provides performance data. These numbers have been run from 2 separate Mac Pros simultaneously, and the results combined to illustrate overall throughput to the storage. The results are presented for both reads and writes using a variety of video formats.

Performance Results

	FlashDisk AFA Series	
Stream Performance	**# of Streams in Read**	**# of Streams in Write**
(4K) 4096 x 2160 10-bit RGB 24 fps	8	3
(4K) 3840 x 2160 10-bit RGB 24 fps	9	3
(2K) 2048 x 1556 10-bit RGB 24 fps	22	8
(HD) 1280 x 720 10-bit 24 fps	68	19
Throughput Performance	**Reads Total (MB/s)**	**Writes Total (MB/s)**
(4K) 4096 x 2160 10-bit RGB 24 fps	7496	3297
(4K) 3840 x 2160 10-bit RGB 24 fps	7395	3070
(2K) 2048 x 1556 10-bit RGB 24 fps	6926	2726
(HD) 1280 x 720 10-bit 24 fps	6078	1682

Table 4 Performance results with FlashDisk AFA Series

Stream Test Conclusion

Winchester Systems FlashDisk AFA is compatible with the latest 12Gb/s SAS drive side and 16Gb/s FC host side connectivity. In order to test how the system would react to multiple users accessing media simultaneously, we used the Apple Xsan file system, which provided the necessary file sharing functionality. We utilized two MAC Pro systems with ATTO 16Gb/s FC Thunderlink adapters as editing clients to deliver high-speed host connectivity.

M&E Solution – Main Components

FlashDisk AFA Series

A high performance and affordable All Flash solution optimal for high throughput applications.

12Gb/s SAS Technology for Expandability and Performance

12Gb/s SAS interface to the drives and expansion BODS - Doubles the previous 6Gb/s transfer speed

Leading Performance

12,600 MB/s sequential read

5,200 MB/s sequential write

Up to 490K Random IOPS

Support for 4K media and beyond

Flexible Host Connectivity Options

Dual host boards per controller enable extra connectivity

Multiprotocol support for FC and iSCSI – field reconfigurable if your topology changes

Online Expansion for Wide Scalability

Add 1 or 2 optional 2U24 SAS 12Gb/s JBODs

Dual SAS 12Gb/s expansion ports to maximize throughput

Up to 72 SSD's per system

Emergency Backup Power

Super capacitors with flash module

Cache data backup to flash module during power outage

Long lasting and maintenance-free

Redundant Core Components to Ensure High Availability

The FlashDisk AFA has redundant core components (controllers, PSUs, FANs), which combined with data services translates to 99.9999% availability

Data and Security Services

Compatible with self-encrypting SSDs (SEDs)

Secure remote replication

Intelligent Drive Recovery (IDR) media scan and error correction

Snapshot, Thin Provisioning, and more

User Friendly / Ease of Use

Intuitive FlashDisk Global Manager and FlashView GUI interfaces

Command line interface customization

Simple but sophisticated UI with full access to features

Green Design

Redundant 80 PLUS power supplies

Intelligent drive and fan spin-down

Other Components in the Environment

Fibre Channel Switching

To create an effective SAN storage topology, one or more Fibre Channel switches are necessary to satisfy the throughput demands from multiple users. Be sure to configure the Fibre Channel switches with the correct settings, such as 16Gb/s FC, 8Gb/s FC or 10Gb/s iSCSI (SFP+) for optimal performance.

ATTO Thunderlink Bridges

The MAC Pro server does not support a Fibre Channel HBA card. The ATTO Thunderlink 16Gb/s FC is the recommended bridge to connect M&E client servers to the FlashDisk AFA via Fibre Channel switches to support high stream throughput. Fibre Channel HBAs can be substituted for the Thunderlink bridge if your client systems support them without affecting the SAN topology.

Cabling
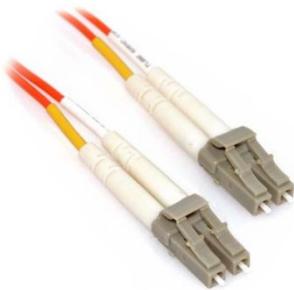
Fibre Channel Cable   Thunderbolt Cable

Fibre Channel cables with LC style connectors are required to connect the various SAN devices including the HBA or Thunderlink bridges, the Fibre Channel switches and the FlashDisk AFA. These cables are available in a variety of lengths to fit your racks or system deployments. Thunderbolt cables are used to connect from MAC Pro to ATTO Thunderlink. The speed of each Thunderbolt cable is 10Gb/s.

File Sharing System Software

The Xsan file system allows simultaneous access to video files from multiple workstations and users. The Xsan distributed file system can be replaced by other similar third-party software, such as StorNext, Sanergy, metaSAN, etc.

Client Workstations

The Apple Mac Pro Workstation is commonly used for video editing. In an editing group, more than one client-editing server is used to work in the same storage pools. Also, other servers can be employed to install editing software such as Apple Final Cut Pro and Adobe Creative Cloud, allowing you to modify the video content.

Conclusion

Winchester Systems is dedicated to providing storage solutions of the highest quality to our customers. This is made possible by the stringent regulations within our in-house manufacturing process that monitor all details of our production lines. Winchester Systems' products are suited for businesses and corporations of various sizes in a range of sectors including government, medical, IT, education, multimedia, database, backup, surveillance and many more. For more details about our products, whitepapers, success stories and other information, please visit www.winsys.com or www.mil-rugged.com or contact one of our representatives.