



# GST Research Report

## Why GST?

## Why GST?



### Abstract

*The protection of information assets has risen to the top of CIO concerns. The strategy selected to protect your organization's data assets has long-term effects on the resiliency of your information systems and the trust that your organization places in them to remain competitive. The most widely used backup and recovery technology remains magnetic tape. A variety of competitive tape technologies exist to choose from. The producers of today's leading tape technologies continue to improve them.*

*GST engineers are developing new features and devices that leverage the better drive speeds and capacities in the newer tape technologies. Some of GST's unique developments are described in this paper. A dedicated manufacturer of tape storage solutions, GST, Inc. is providing this Research Report as part of its commitment to provide information leading to the better management of data and application protection within the IT industry.*

3419 Via Lido, Suite #164 • Newport Beach, CA 92663  
949.673.1248 • 949.673.3163 Fax • <http://www.gstinc.com>



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## Why GST?

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## Why GST?

### **Preface**

This GST Research Report summarizes recent engineering developments that GST has integrated into their tape backup and recovery solutions. Technologies utilized include AIT, SAIT, SDLT, SLR, DAT, and LTO. Solutions are packaged in internal, single, dual, autoloader, and library configurations.

Today's high-capacity, high-performance and high-reliability tape technologies are making the backup, restore and Disaster Recovery functions both more effective and more efficient. GST's unique product innovations are designed to work with these newer tape technologies to fulfill some of the unmet needs in backup, recovery and DR today.

What follows is a review of some of the unique GST product developments and how they can be used to the benefit of organizations concerned with the fail-safe protection of their data assets.



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## Why GST?

### Forward: GST and our Manufacturing Partners

GST's company profile on its website states,

"GST Inc. engineers, manufactures, markets and sells a line of innovative storage products to meet the need for high-performance, 24 X 365 reliability and cost-effective data storage. These products include tape solutions, storage-related software and services."

To create our unique tape products (single drives, dual drives, autoloaders and libraries), GST partners with leading manufacturers of tape drive units and autoloader/library automation devices. Some of these manufacturers and the products that GST obtains from them as an OEM are shown below.

Tape Drive Partners	AIT	DAT 72	LTO	SDLT	SAIT	SLR
Certance		x				
HP			x			
IBM			x			
Quantum				x		
Sony	x				x	
Tandberg Data						x

Automation Partners	AIT	DAT 72	LTO	SDLT	SAIT	SLR
Overland Storage			x	x		
Qualstar	x				x	
Sony	x					
Tandberg Data						x

GST engineers its own unique features and capabilities for the tape drives, autoloaders and tape libraries that we OEM from these leading manufacturers. We integrate our value-added capabilities into the OEMed products. For example, the core drives and media that we use for AIT and SAIT (Super-AIT) are manufactured by Sony Electronics. We OEM the drives and media from Sony and add our own GST Tape Controller and LCD Operator Panel to produce unique AIT and SAIT backup solutions featuring GST's own intellectual property.



GST's GrowthDR Library – Qualstar Partner

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### GST's LCD Operator Panel

#### Why is an LCD Operator Panel needed?

Many tape units, single or dual, are located at remote sites and operated by non-IT personnel. These units generally have two or three colored lights to communicate the present state of the unit to the person assigned to take the daily backups. Such a scheme is not conducive to communicating the status of the drive whenever intervention of any type is needed. In its research into backup needs, GST's developers discovered a strong interest in a display that would provide operators critical backup status measures like tape presence, readiness, when to clean, movement operations and remaining unused capacity.



Single SAIT-1 Tape Drive with 2x40 LCD

#### How does the GST Operator Panel work?

GST developed an intelligent LCD Module that contains the GST Operator Panel that permits the operator to monitor many aspects of the backup/restore operation. One type of GST Operator Panel is enabled for tape technologies using 3.5 inch drive form factors. It uses GST's patented LCD Module to hold both the 3.5 inch drive and the GST Operator Panel's LCD display and components within a standard 5.25 inch drive bay. It has a 2x8 LCD screen (two rows of eight characters each).

Another GST Operator Panel for tape technologies with 5.25 inch drive form factors has a 2x40 LCD screen (two rows of 40 characters each); this unit is also used in the GST Commander™ Tape Controller.



Single AIT-3 Tape Drive with 2x8 LCD

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### What messages are displayed?

The LCD Panel continuously displays key drive functions and status of the backup operation. The following key operational status indicators are displayed:

**Presence:** tells whether a tape cartridge is present or absent in the tape drive. This fact is not always visible by simply viewing the drive.

**Ready:** whether the tape drive is ready for operation or not.

**Clean Me:** the need for cleaning functions to be performed on the drive.

**Read:** this status is displayed when a read operation is taking place in the drive.

**Write:** this status is displayed when a write operation is taking place.

**Load:** this status is displayed when a tape cartridge is being loaded into the drive.

**Unload:** this status is displayed when a tape cartridge is being unloaded from the drive.

**Rewind:** this status is displayed when the tape cartridge is being rewound.

**Position:** this status is displayed when the tape cartridge is being positioned prior to reading.

**Remaining MB:** the remaining megabytes of unused capacity on the tape, updated as data is written to the tape. This is displayed in uncompressed bytes. It can be used to determine when the capacity of the tape has reached its limit.

### What are the benefits of an LCD Operator Panel?

Continuous display of the ten most-critical operational factors ensures that even an inexperienced operator of tape backup and restore functions has awareness of all key performance and operational measures of the tape unit. This additional information can eliminate errors made by operators based on incomplete information or lack of trained operational skills.



### Rackmount Model – Six AIT-3 Tape Drives with 2x8 LCDs

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### Where does GST implement its LCD Operator Panel?

GST incorporates its LCD Operator Panel throughout most of GST's product line. See the chart below.

Family	2x8 LCD	2x40 LCD
InternalDR - Single Drives	X	
EntryDR - Single Drives, External	X	X
SafeDR - Dual Drives		X
AutoDR – Autoloaders		
GrowthDR - Midrange Library		X
ScalableDR - Enterprise Library		X



**Rackmount Model - Single SAI T-1 Tape Drive with 2x40 LCD**



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## Why GST?

### GST's Mirrored Backup

#### Why is there a need for Mirrored Backup?

One need has to do with the larger capacities of tape cartridges. Today, capacity per cartridge is up to hundreds of Gigabytes, quite a contrast to older cartridge capacities of 5 or 10 Gigabytes. Higher cartridge capacities result in backup operations that store the entire backup on one or two cartridges. This can cause some exposure in the restore process since the failure of one cartridge now affects a much greater portion of the backup data than before. In the past, if one cartridge of a 10-cartridge backup set was bad, there was a good chance of restoring the other nine cartridges. However, when a higher-capacity cartridge fails, much more of the backup data can be lost. This has underscored the need for redundant (mirrored) backup sets to protect against this unlikely but serious loss.

Another need has to do with the *backup storage dilemma*. Backup cartridges need to be stored *near the IT installation* so they can be retrieved faster to accelerate the restore process. However, it's also true that backup cartridges need to be stored *near the disaster recovery site* in case the primary IT installation is rendered inoperable. Thus, the backup cartridges must be stored somewhere nearby the server for rapid restores, but also near the DR site in case of a catastrophic failure ... obviously cartridge availability is a critical issue to major IT organizations.

The best way to solve both of these needs is by having a second set of backup tapes.



#### Dual LTO-2 Tape Drive – Used for Mirrored Backups

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## Why GST?

### How does GST implement its Mirrored Backup Technology?

Mirrored Backup technology works the same for stand-alone drives, dual-drive mirrored tape subsystems and for a GST tape library with two drives. The objective is to produce identical sets of backup cartridges that have identical tape volume serial numbers.

GST's **Server-Transparent Media Duplication (STMD)**™ technology delivers identical sets of backup tapes with no server penalty. The GST Commander™ Tape Controller contains logic that enables any dual-drive tape subsystem or library to perform a Mirrored Backup. GST's Tape Controller takes the backup data from the server and writes it simultaneously to both tape drives. The GST Commander™ Tape Controller places no extra burden on the server to produce the identical backup sets. There is no overhead software and no performance degradation. The controller also has an RS232 interface for downloading diagnostics to IT support organizations; ideal in distributed computing environment with untrained operators.

The scope of potential lost backup time increases every time cartridge capacities increase. We call the new standard requiring duplicate tape backup sets **Mandatory Redundant Backup**. "Every installation of any significant size should set mandatory redundant backup as their minimum backup strategy," reports David Breisacher, Chairman and CEO of GST, Inc.

For more information on how GST implements Mirrored Backup, see GST's Research Report: *The Need for Mirrored Backup* at <http://www.gstinc.com/white/mirrored.pdf>

### What are the uses of Mirrored Backup?

GST's exclusive Mirrored Backup Technology strengthens backup, restore and disaster recovery (DR) processes. One backup set is safeguarded remotely for rapid access in the event that a disaster recovery procedure needs to be initiated, thus ensuring the rapid deployment of DR activities. A second identical set of backup cartridges can be retained at the server site so as to be immediately available for expediting the restore process.

Mirrored Backup protection eliminates the need to restart and repeat a save or restore process when a tape drive or media cartridge fails, which we call **Fault Tolerant Backup**. There are two types:

- **Backup Fault Tolerance** –If one drive fails during backup/restore, the second drive continues with the operation, ensuring its successful completion.
- **Restore Fault Tolerance** – If one tape is bad or missing during the restore or a DR operation, a second set is readily available so that serious delays can be avoided.



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Finally, added tape functions are also enabled via the GST Commander™ Tape Controller:

- **Off-Line Copy:** Permits copying one set of cartridges to another set, producing duplicate sets. No server cycles are used.
- **Off-Line Verify:** Same as Off-Line Copy, except the data on the cartridge in one drive is compared and verified to be identical to the data on the cartridge in the second drive.
- **Cascade:** Permits switching control from one drive to another drive, once the first drive is full during a backup operation. This doubles the unattended backup capacity.

Mirrored Backups can be a key weapon in the organization's arsenal to fight off the growing array of threats that can bring a system down, and the organization along with it.

### Where does GST implement its Mirrored Backup?

GST incorporates its Mirrored Backup technology in products that have two drives. See the chart below.

Family	Mirroring Available
InternalDR - Single Drives	
EntryDR - Single Drives, External	
SafeDR - Dual Drives	X
AutoDR - Autoloaders	
GrowthDR - Midrange Library	X
ScalableDR - Enterprise Library	X



Dual (Mirrored) SAI T1 Tape Drive

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### GST's Backup Consolidation

#### Why is there a need for Backup Consolidation?

With the growing number of servers within a single data center, the complexity of backing up those servers to tape increases as servers grow. For example, having 25 separate tape backup units, rather than two, creates complexities in both the care and operation of the tape units, along with the likelihood that one could be about to fail. Creating the ability for a tape library to backup multiple servers becomes advantageous, since the backup function can be consolidated within the tape library unit.

#### How does GST implement its Backup Consolidation?

GST's **Virtual Library Partitioning** within its Tape Library Controller creates virtual libraries for each drive in the library. For example, GST's eight module Enterprise LTO Library has eight modules, each with up to two drives. When the modules are configured with two drives, the Enterprise LTO Library can backup 16 servers.

GST also implements **Virtual Library Partitioning (VLP)** with the two-drive model of the Midrange AIT Library. With the VLP feature, cartridge slots can be assigned to a particular drive so the library is divided into two partitions. Each partition can be assigned to a host server or Logical Partition (LPAR). Thus, two different servers or LPARs can be backed up within a single tape library and the cartridge allocation is assigned based on the relative capacities of the two backup hosts.

#### What are the benefits of GST's Backup Consolidation?

GST's Backup Consolidation with **Virtual Library Partitioning** provides the following benefits:

- Consolidation of backup hardware.
- Configuration simplification.
- Cost reduction.
- Lower software license fees and maintenance costs.
- A smaller footprint at the data center.

#### Where does GST implement its Backup Consolidation?

GST implements Backup Consolidation in the following families listed below:

Family	Backup Consolidation
GrowthDR - Midrange Library	X
ScalableDR - Enterprise Library	X





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## Why GST?

### What are the benefits of GST’s modular packaging?

- **Small-Footprint** – The small dimensions of GST’s modular enclosure for its drives with a 3.5 inch form factor result in units that only weigh 3 pounds and are only 3.5 inches tall -- a stack of six is less than two feet high. All this combines to save valuable datacenter space.
- **Field-Replaceable Unit (FRU)** – GST uses the concept of FRUs in developing its tape products. If a modular tape unit needs to be examined or repaired, the entire unit is treated as a FRU and a replacement can be trans-shipped to the customer to provide a fully-working unit while the suspect unit is shipped to a service location. Furthermore, many GST library components are packaged in easily-installed FRUs requiring no wiring. Quick-Swap drives, power supplies, controllers and robotics are easily removed/installed simplifying field servicing.
- **Building-Block Modularity for Upgrading** – All GST modular drives are field-upgradeable by GST’s own technical support organization or by customers themselves. GST Single AIT Subsystems can be field upgraded to Dual AIT Subsystems using GST’s modular and stackable drives with intelligent GST controllers. These upgrades strengthen DR capabilities, add fault tolerant backups and increase unattended backup capacities as volumes grow.
- **Investment Protection Features** – GST’s modular design used in its Single and Dual Tape Subsystems, and its Enterprise Libraries, permits adding drives, cartridge slots, functionality and upgrading tape technologies. Field upgrades protect user investments in originally-installed GST units. For example, single AIT modular drives can be upgraded to dual-drive systems; the original drive is fully incorporated, providing investment protection.

### Where does GST implement its modular packaging?

GST implements its modular packaging as shown in the chart below.

Family	Modular Packaging	Technology
EntryDR - Single Drives, External	X	AIT
SafeDR - Dual Drives	X	AIT, SLR



**Dual SLR Tape Drive – Utilizing Modular Packaging**

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### GST's Rackmount Enclosure

#### What is the significance of a rackmount enclosure?

Rackmounted peripheral devices in a server or storage tower serve to incorporate these devices as an integral part of the server and standard rack.



SDLT Rackmount Model



LTO Rackmount Model

#### How does GST implement its Rackmount Enclosure?

GST engineers went beyond a basic rackmount kit to develop a full GST Rackmount Enclosure with its own power, fans, cabling and attachments to hold GST tape units. This Rackmount Enclosure has a height of 2U. It is used to hold any of GST's Single Tape Subsystems or Dual Tape Subsystems. Differing tape technologies can be mounted side-by-side so long as the form factors are the same. Fibre and SCSI connection can co-exist in the same rack. Here are the combinations possible:

Rackmount Enclosure for 3.5 inch form factor drives:

- Any combination of AIT (AIT1, AIT2, AIT3) and DAT 72
- Two single drives and their LCDs
- One dual drive unit with its controller and LCD

Rackmount Enclosure for 5.25 inch form factor drives:

- Any combination of LTO, SAIT, SLDT
- Up to six single drives
- Two dual-drive units including two controllers with LCDs

#### What are the benefits of GST's rackmount enclosure?

- **Flexibility** – holds dissimilar tape technologies, Fibre and SCSI for complete flexibility in its configuration.
- **Space Saving** – compresses a significant number of different tape devices into one rack that only takes up 2U of the server or auxiliary tower.



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## Why GST?

### Where does GST implement its rackmount enclosures?

GST implements its rackmount enclosures as shown in the chart below.

Family	Rackmount Enclosures
EntryDR - Single Drives, External	X
SafeDR - Dual Drives	X
AutoDR - Autoloaders	
GrowthDR - Midrange Library	
ScalableDR - Enterprise Library	



SAIT Rackmount Model



AIT Rackmount Model



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### Why GST?

## GST's Bridges for Connection Support

### What problems exist with SCSI and Fibre Channel compatibility?

Any tape device that is operating with one of the three standard attachment protocols (LVD SCSI, HVD SCSI or Fibre Channel) may need to be switched to a host that communicates in another protocol. In addition, some tape automation devices are designed to operate with just LVD SCSI or just Fibre Channel, yet it is desired to attach them to an older iSeries or other server that only supports HVD SCSI attachment protocols.

### How does GST ensure support of these connections under any conditions?

GST engineers developed a family of BridgeLink™ bridges to provide easy interconnection between Fibre Channel devices like a SAN and SCSI devices like a tape drive, autoloader or tape library. GST bridges are optimized for to enable a high-speed Fibre Channel initiator to communicate with a SCSI target. SCSI devices can connect at up to 200MB per second, accommodating the slower HVD as well as the faster LVD SCSI devices.

GST provides its bridges in a desktop enclosure, or in a standard rackmount enclosure with a 2U vertical dimension.

### What are the benefits of GST's connection support?

- **Protocol Conversion** – Meets the need to convert SCSI-based storage devices to operate within a Fibre Channel network. Also permits using older and slower backup solutions that attach via SCSI with faster Fibre Channel devices, like a SAN.
- **Future Growth** – Fibre Channel is the accepted protocol for future network expansion on most medium sized servers. Existing storage devices can be used with fibre networks as they are added later.
- **Investment Protection** – Bridges permit use of older legacy devices with fibre networks or any older connection like HVD. This preserves the investment in older tape solutions. As devices are shifted around, GST bridges can be added or removed to accommodate them, attaching to hosts with different connection protocols.



GST Fibre to Bridge Switch

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### Why GST?

## GST's iSeries Connectivity

### What is the significance of iSeries connectivity?

IBM's iSeries servers use a proprietary architecture that does not easily connect with peripherals other than those provided by IBM. This results in restricted choice of storage devices such as memory, tape and disk for the iSeries.

### How does GST implement its iSeries connectivity?

GST's Commander™ Tape Controller is uniquely designed to interface directly with IBM iSeries servers, a proprietary platform running under IBM's OS/400 operating system. GST engineers' experience with iSeries technology produced a seamless marriage of the GST's tape storage devices and the iSeries.

David Breisacher, founder, CEO and Chairman of GST, Inc., has built a team of storage specialists with extensive background on the iSeries platform. The GST Advisory Board and GST Engineering Panel provide significant experience and know-how about iSeries servers to GST. The result is a set of storage solutions that run smoothly on the iSeries and its predecessor the AS/400.



GST Commander Controller – iSeries Connectivity Enabled

### What kinds of iSeries connectivity exist with GST products?

GST's products attach natively with LVD (low voltage differential) and HVD (high voltage differential) SCSI connectivity, and with Fibre Channel (FC) through GST bridges and routers. In fact, all of IBM's eServer family members (iSeries, pSeries and xSeries servers) are supported in this manner.

For the Fibre Channel (FC) connection, single and dual drive models connect through GST's BridgeLink™ family of bridges and SanMatrix™ family of routers. GST's Midrange AIT Library connects directly to FC via a variety of Fibre adapters.



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In addition, internal attachment of AIT single drives operate exclusively on every iSeries model resulting in a high degree of integration, simplifying drive containment and eliminating high connection costs.

### Where does GST implement its iSeries connectivity?

GST implements its iSeries connectivity as shown in the chart below.

Family	iSeries Attachment	Technologies
InternalDR - Single Drives	x	AIT
EntryDR - Single Drives, External	x	AIT, SAIT, LTO, SDLT
SafeDR - Dual Drives	x	AIT, SAIT, LTO, SDLT, SLR
AutoDR - Autoloaders	x	AIT, SAIT, SLR
GrowthDR - Midrange Library	x	AIT, LTO, SAIT, SDLT
ScalableDR - Enterprise Library	x	SAIT, LTO, SDLT





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### Why GST?

#### Conclusion

Increasing demands for high capacity, faster and more reliable backup solutions are creating a continual need for IT departments to examine backup and restore operations. New technologies present a continual new host of solutions for this process. Manufacturers of backup solutions are continually evolving their products to meet the new challenges with the best tape technology available.

Today, installations are not only grappling with expanding databases and transactions volumes, but with shrinking windows to perform backups and even less time for restores. Moreover, compliance with major recordkeeping regulations has become a major concern this year and will be so for years to come.

The evolution of GST's patented backup solutions like Mirrored Backup, Backup Consolidation, the LCD Operator Panel, modular packaging, rackmount enclosures, connectivity support and iSeries connectivity all reflect GST's response to the need for more innovative solutions to ensure failsafe protection of the organization's data in a changing environment.

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## Why GST?

### About the author

This GST Research Report was prepared under the leadership of David Breisacher, CEO/Chairman at GST. David is the founder of several successful companies, including GST and BCC Technologies, a manufacturer of eServer disk, tape and memory storage devices. A visionary for the storage industry since the early 90's, David lends his market insight and predictions for the IBM midrange storage marketplace to the research conducted at GST. His experience in sensing shifts in technology and industry directions has made it possible for him to organize and structure successful companies to rapidly meet the evolving needs of storage users.

### Feedback

We value your feedback on this GST Research Report. Please send your comments, suggestions and questions to: [research@gstinc.com](mailto:research@gstinc.com).

### About GST, Inc.

GST Inc. engineers, manufactures, markets and sells a full line of innovative storage backup and restore products to meet today's need for high-performance, fail-safe reliability and cost-effective data storage for a large variety of servers. GST's advanced tape solutions focus on improved backup/restore processes and enhanced disaster recovery. Products range from single and dual tape subsystems and autoloaders to midrange tape libraries and modular enterprise-wide libraries. Unique modular design enables field upgrades, scalability, investment protection and lower life-cycle costs. Development is guided by expert advisory boards that closely track market needs and ensure use of the latest engineering technology in product design. Complete information about the company, its products and support can be found at: [www.gstinc.com](http://www.gstinc.com).

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