DATALOGIC™

Case study

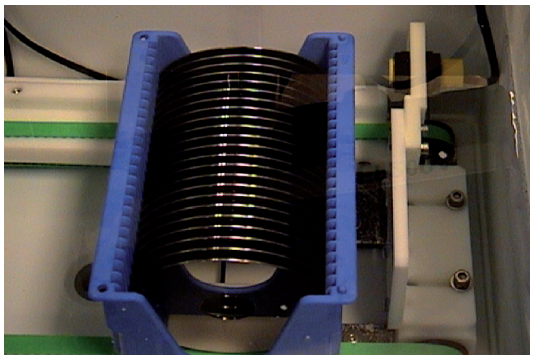
# Disk Drive Manufacturers Move Ahead with **RFID-Enabled** Media Process Line

*The world's disk drive manufacturers are positioned at the heart of today's information-centric world.*

Throughout their history, disk drive manufacturers have successfully relied on a strategy of ownership and vertical integration of key underlying technologies. In the last several years, leading HDD manufacturers have used RFID systems to gain competitive advantage in their HGA and media manufacturing processes. Evaluation of RFID systems in head operations is possible.

In order to respond quickly and intelligently to the rapid changes in the industry and to deliver new storage products rapidly to a price-sensitive consumer market, disk drive manufacturers are always looking to optimize their manufacturing operations and gain visibility into the internal supply chain often to achieve Six Sigma proficiency within manufacturing.

This visibility additionally affords an improvement in current accountability of process tools, highlight process improvement opportunities, minimize manufacturing rework and automate line processes. Maintaining a leading position in the highly competitive hi-tech manufacturing market demands continuous improvement within its manufacturing operations. Increasing production yield while reducing scrap has a direct impact on customer satisfaction by accelerating demand fulfillment capability and supporting competitive market pricing.



## Increased profitability and supply chain efficiency

• Driving to improved production yields in a high-volume, mixed product manufacturing shop floor
• Sharing of real-time demand and production data to synchronize multiple production facilities

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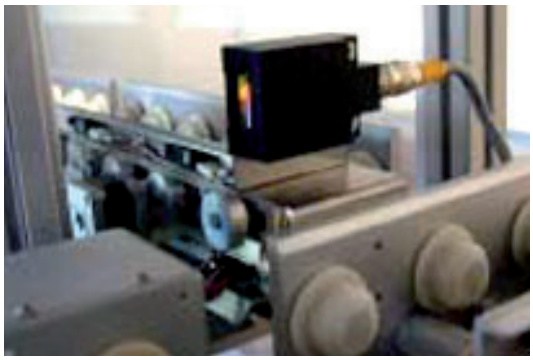
## Improved quality

• 6 Sigma quality control capability with measurable metrics.

Several HDD companies have implemented RFID WIP tracking solutions to track materials, processes, and equipment used in their HGA and media manufacturing processes. This provides detailed information about:
• Material consumption (raw in, WIP, finished out)
• Material containment (defects by process )
• Key process indicators (labor, run rates, WIP tracking)
• Movement of material (raw to WIP to finished good inventory) with verification.

## Problem Statement:
## Improve traceability and manufacturing yield

HDD manufacturing processes are complex and encompasses numerous steps that convert aluminum blanks into high density data storage media that are used in hard drives for instance. The manufacturing operations are performed in a Class 100 clean room environment with material flowing through harsh conditions than contain metal, liquid, magnetic materials.
Since manual handling of blank discs can cause production problems and reduce production yields, disk drive manufacturers use a custom designed carrier throughout manufacturing to reduce contamination and achieve process precision.
In order to achieve end-to-end manufacturing traceability, manufacturers require the disc carrier to flow through a controlled environment and capture the Work-In-Progress (WIP) information like lot number, cycle time between processes, carrier routing and resources used for every carrier under operation.
Drive manufacturers migrated from using paper travelers for WIP tracking to manual input terminals located throughout the process line. By using manual input traceability accuracy was often lost due to operator (human) input errors. Engineers later experimented with barcode technology but found the labels could not reliably survive the processing steps and barcodes being a read-only recording media fell short of meeting the read/write requirements. It was impacting production throughput and since the WIP data was not accessible in real-time; it led to delayed decision making.



## Drive Manufacturers' Requirements

Media and other disk drive processes basic disk processes consist of many interrelated steps grouped into five major categories.
Disk drive manufacturers require that every carrier that goes through each station be validated against different manufacturing

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criteria to ensure that the right operation is being performed on the right lot, by the right tool and has the right pre-processing conditions. It needed these validations to be performed in real time at every station and record the results of the process conducted at the station in their factory information system prior to routing the carrier to the next operation.
An RFID-enabled WIP solution includes:
• RFID readers that communicate and control the tool operations
• RFID read/write tags that are embedded into the carrier and can handle harsh processing environments. These tags retain processing information that can be read easily among different plant locations and vendors.
• WIP application software that enables current processes with RFID and manage the WIP data between their enterprise systems and the factory floor operations

## Common 'Pain Points'

Several 'pain points' exist in all complex manufacturing systems. The RFID enabled media and HGA carriers implemented by HDD manufacturers provide the real-time data or complete process traceability that lets managers resolve these 'pain points'.
1. Process bottlenecks. Real-time data from RFID enabled processes allow plant managers to know precisely where each bottleneck is and what the real capacity is at that point. This information is critical for efficient planning for capacity upgrades and daily manufacturing operations.
2. Quarantines. Minimizing the financial loss caused by process upsets, flawed raw incoming materials and even post sale recalls such as Dell Computer's recent 'exploding battery' recall. Having critical details of how every part is processed tucked safely away in a database can save huge amounts of money when these manufacturing crises occur.
3. Process optimization for yield. Often the final test yield/sort is the final arbiter of process yield. With detailed information on high yield parts processing history, processes can be 'tweaked', high/low yield process tools isolated and the continuous improvement programs moved forward. The process data stored in RFID enabled carriers provide the common thread tying final test yield back to each process step.
4. Mis-processing. Real-time automated decision making based on the data stored in each RFID enabled carrier prevents mis-processing at each decision point preventing lost product due to mis-processing.

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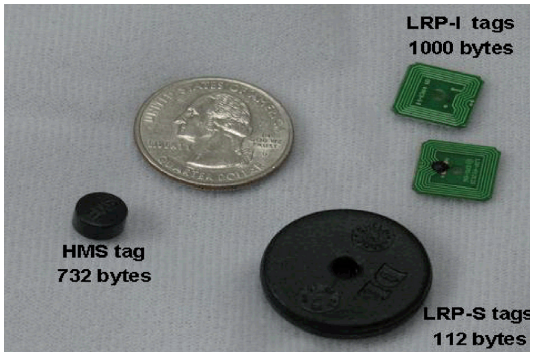
## RFID: A Forgiving System

It is always difficult to get a complex data management system operating seamlessly especially when operating across different plants, sites and companies. Sometimes gaps persist in these systems that can easily be remedied only when an RFID-enabled carrier acts as the common 'thread'. The RFID tag on these carriers allows data mapping and reading and writing with no more overhead than installing an RFID reader on a local PLC or PC. This data is now accessible at a later processing stage or at a later time. The forgiving nature of the RFID enabled system can take the heat off the IT or manufacturing departments to get processes up and running quickly.
Solution Component: RFID Read/Write Tag Escort Memory System's HMS and LRP-I tags are used by drive manufacturers. These tags are small (the size of an 8mm button) with large re-writeable memory areas most suited for industrial application and capable of surviving harsh processing environments. These tags are embedded into each carrier and are capable of storing up to 1000 bytes of user data. Read/write operations can be reliably performed at a range of 18 mm or more while typically surviving several thousand cycles of use. The tag data on each carrier typically holds lot information, routing information and WIP data in defined areas described by a tag memory map. At the beginning of every process, readers read these data sets and pass it to the local WIP software interface for processing instructions. On every successful process completion the tag is updated with new WIP data from that process.

## Solution Component: RFID Reader and Antenna




Escort Memory Systems' HF-0405 (shown), HMS 827 and Cobalt HF integrated reader/antennas are used disk drive WIP solutions. These RFID readers are configured to take action based on the PLC (Programmable Logic Controller) triggers. For instance, a reader is triggered to read/write to the tag only when a new carrier enters the tools.
The HF and HMS reader's small form factor allows them to be easily mounted on the tool at the entry and exits points of each processing station where data can be reliably read and written to the carrier tags. Cobalt HF readers larger form factors allow reading and writing at greater distances when required.

## Business components

• Process traceability –managed product history and validations through data on the RFID tag
• Product validation – setup verifications and alerts based on process type, route and time
• Process containment – setup business rules to manage throughput and product routing.

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## Solution Benefits

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## Solution Benefits

The implementation of the system demonstrated significant improvements in yield through the reduction of manufacturing bottlenecks and provision for preventative actions. These RFID-enabled WIP benefits have proven themselves and become a standard feature of many HDD production projects for media and HGA lines. Evaluation of RFID systems in the head processes could yield similar benefits.
With the system alerting production floor operators and supervisors when quality measurements were outside of manufacturing specifications facilitated immediate corrective action that eliminated redundant processing and reduced scrap. Downtime tracking through system reports rapidly identified manufacturing bottlenecks while providing maintenance with real-time information on machine status.

The solution provided tangible benefits that included:

Real time visibility into the internal supply chain:
- Increased revenue and profit potential through enhanced visibility of the entire production process

Reduction in material variances:
- Source of the variance was immediately visible with shorter reconciliation times

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Detailed product traceability:

- Tying specific material lots to production orders helped determine cost immediately
- Defect exposure was significantly reduced with traceability to the exact impact areas

Significant reduction in labor retraining and management:

- Improved processes identified the most effective and automated routing of products and activities with minimal impact to labor
- Enhanced employee productivity through employees being freed from manual product-tracking tasks to focus on value-added manufacturing activities.

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