Presentation for NSSDC Conference

Mass Storage Systems and Technologies for Space and Earth Science Applications

ATL Products Division's Entries Into the Computer Mass Storage Marketplace

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Odetics Background

- **High Tech Company Founded in 1969, Publicly Traded**
  - Serving Well-Defined Niche Markets
  - Through Variety of Product Groups
- **Roots are in Space Borne Recorders**
  - Own 80% of Marketplace
- **Evolved Into Robotics in Mid-70s**
  - AIM, Broadcast, DMS, ATL Products Divisions
  - 35% of Revenues and Growing
  - Technology and People Move From One Division to Another

Product Evolution

- **Robotics Genesis - AIM**
- **Company's High Technology Group**
  - 1979 Committed to a Six Legged Robotic System
  - 18 Months Later Demonstrated ODEX I
    - Symbol of the Corporate Commitment to Robotics
  - Demonstrates High Strength to Weight Ratios
  - All Electric, Compact, Extremely High Performance
  - Six Units Built - Three Generations of Technology
    - Predominantly for Nuclear Plant Maintenance
- **Evolution to Other Robotic Subsystems**
  - Arms, Hands, and Effectors

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Product Technologies and Markets Served

- **Innovators in "Small Package" Handling**
- **Do Not Serve General Purpose Robotics Handling Market**
- **Design Intent of Our Products**
  - Move "Small Light Weight Objects" Very Quickly
  - Accent On Longevity of "Object" Being Moved
  - High Degree of Reliability
- **Necessitates**
  - Expertise in Low Mass, Light Weight, High Speed Systems
  - Requires Unique Robotic Handlers, Arms, End Effectors
  - Products Designed for Niche Markets
    - Aperture Card Storage Module Systems
    - Tape Cassettes and Cartridges
    - Optical Disks

Product Evolution
Infodetics' Aperture Storage Module Library

- **First Linear Servo Based Expandable System**
- **Modules: 10 Ft. Long By 3 Ft. Deep By 7 Ft. High**
  - 2000 Cartridges Per Two Rows or Module
  - 100 Aperture Cards Per Cartridge
  - Robotic Handler in Aisle Between Rows Within Module
- **Large System With Multiple Modules and Pass-Through**
- **5 Seconds Average "Pick and Place"**
  - Access Cartridge and Load Into Aperture Card Reader
- **Document Management System "Storage Server"**
  - Cache Microfilm Images to Disk
  - Transmitted to Work Stations for Viewing

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Product Evolution
Broadcast Division's TCS2000 Video Cart

- **First "Tower" Based Expandable System Introduced '86**
  - Designed as a TV Station or Network Automation System
- **Built as Part of a Joint Venture With RCA in 18 Months**
  - RCA Dropped Out, Odetics Entered End User Market
- **System Consists of:**
  - Robotics and Up to 6 Tape Recorders Per Tower
  - 225 to 300 Tapes Per Tower Depending On Formats
  - Switchers, Sequencers, Monitor and PC Based Work Station
  - Hierarchical Software
    - Real-Time Controller/Operating System, Relational DB, Playlist
- **Supports VHS, Beta, D-2 Formats**
- **Robust, Redundant and Extremely Reliable**

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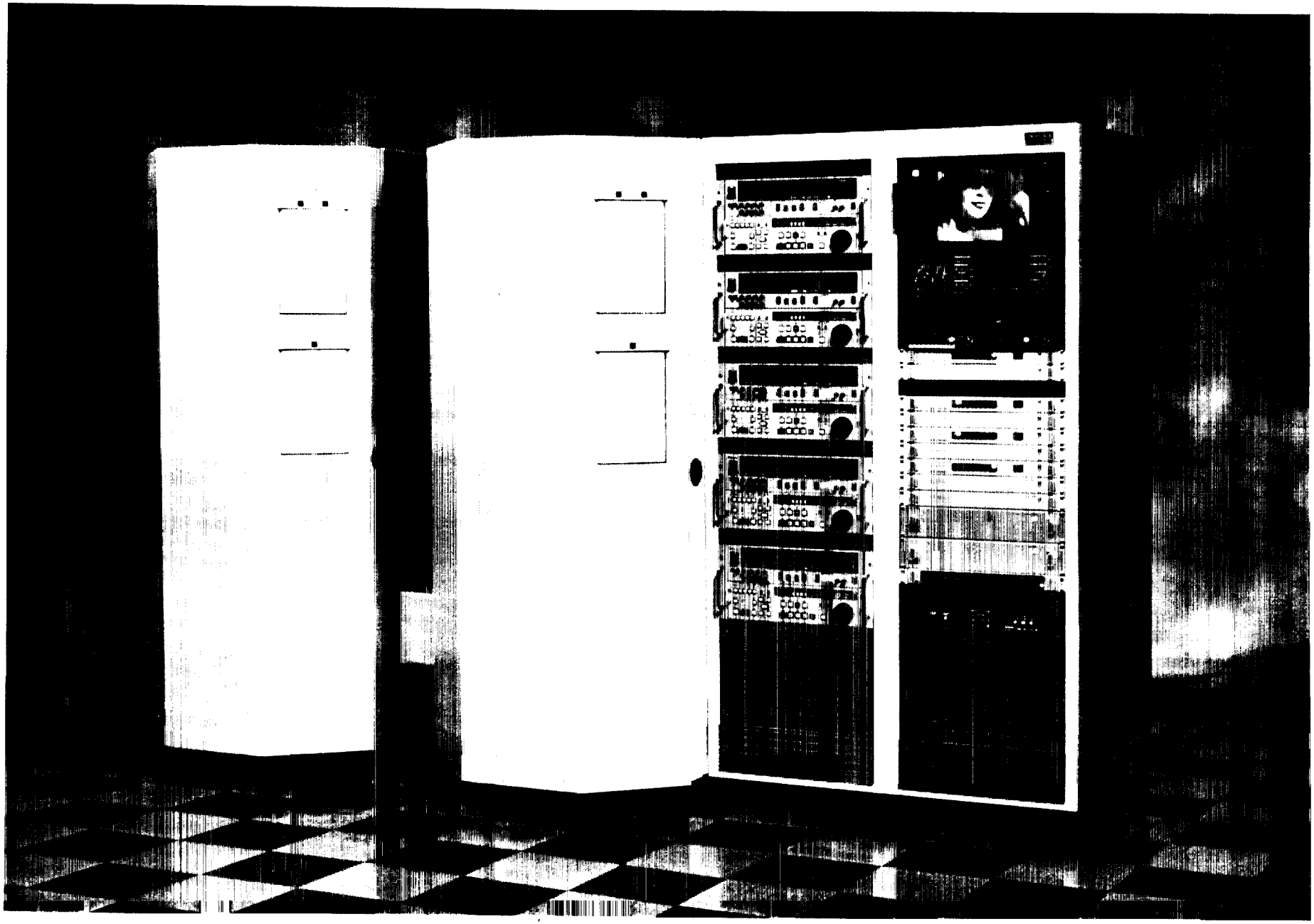

The Cart Machine™ with Library Expansion Module

Odetics Broadcast

Broadcast Division's Newest Product
TCS90 Videocart System

- **Bookshelf Design**
  - X-Y High Speed Linear Servo System
  - One Armed Gripper With Holding Tray
- **Accommodates Combination of Cassette Sizes and Format**
  - Beta SP, VHS, or D-2
  - Small and Medium Sizes
- **Tape Recorders are Standard: Non-Modified**
- **Autoloader Accommodates Up to 8 Cassettes**
- **Fixed Size**
  - No Expansion Capabilities
- **Software From TCS2000 Migrates Directly to This Product**
  - 50 Man Years of Development

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ATL Products Division
Marketing Strategy

- **Serve the Evolving Computer Based Mass Storage Market**
- **Develop Tape Storage Library Subsystems**
  - Robotics, Control, Storage and Computer Interfaces
  - Support a Broad Range of Tape Sizes and Formats
  - Interface to a Variety of Tape Drives in Each Size
  - Provide Low Level Library Control and Management Software
- **Sell Through Distribution Channels That:**
  - Integrate Tape Drives
  - Add High Level Mass Storage Management Software
  - Service a Broad Range of User Markets
  - Provide "Private Labelled" and "General Purpose" Products
- **Pursue Major Market Shares**
  - High Density/High Capacity Storage Market
  - General Commercial Market By Supplying a Range of Solutions

High Density Systems Business
Product Lines

- **Developing Two Basic 19mm ATL Storage Subsystems**
  - To Serve High Capacity Markets: Terabytes and Petabytes
  - Support Small and Medium Size D-2 Cassettes
- **Expandable "Tower" Based System**
  - Broadcast System as Platform
  - Auxiliary Towers for Expansion
  - Delivered March, 1991
- **New Linear Aisle Based Expandable System**
  - 30 Months in Development: Delivery August, 1991
  - Most Advanced Robotic System On the Market

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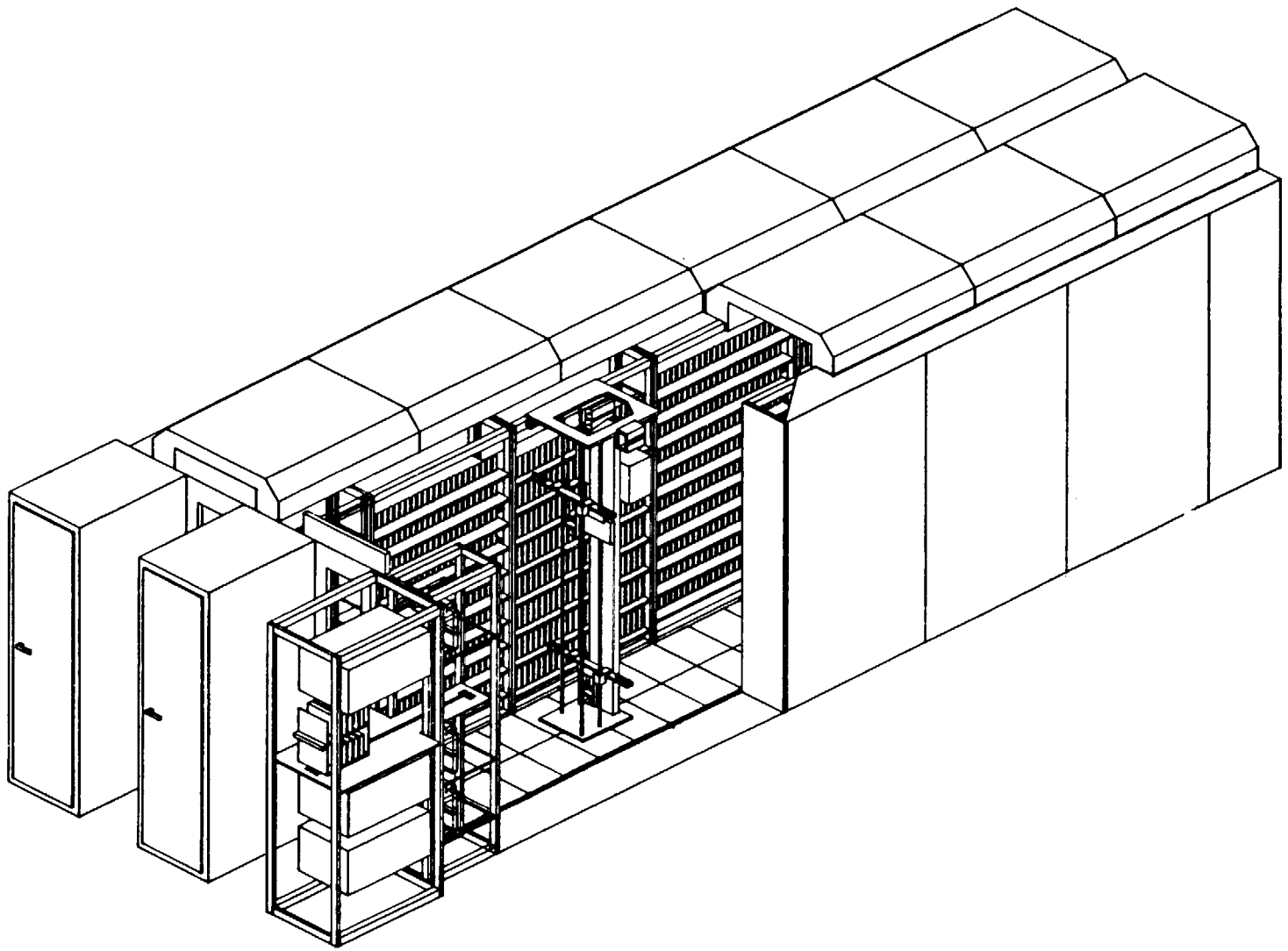

Odetics aisle-based automated tape library subsystem. Cut-away shows robot that moves up and down aisles of tapes. Tapes are stored and retrieved by the robot and placed into tape drives.

Odetics ATL Products Division

High Density Systems Business Product Lines

- **10 Minute Video On Two Technologies**
  - Copies of Video Available Upon Request

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E-Systems Business Relationship

- **Exclusive Supplier of 19mm ATL Subsystems**
  - Computer Mass Storage Marketplace Only
- **Can Market Other Odetics ATL Subsystems**
- **E-Systems is the Integrator**
  - Providing Systems Expertise - ATLs, Tape Drives, Computer Integration
  - Library Management Software for the ATLs
  - Supplying Storage Server Software

3480 "Medium Size" Library
First Commercial Product Offering

- **"300" Cartridge Baseline System**
  - Expandable in Increments of Approximately 300 Cartridges
  - "1500" Cartridge Maximum
- **Up to 2 Tape Drives Available in Baseline**
  - Up to 4 Additional Drives as System Expands
  - Supports All Low Cost 3480 Tape Drives
- **Small Footprint**
  - Fits Standard 28 Inches Wide By 45 Inches Deep By 78 Inches High Cabinet
  - Very High Density Storage
- **Cartridge Autoloader and Bulk Loading**
- **RS-232C or SCSI-II Interface**
- **Serve the Distributed Computing and File Server Markets**

Storage and Library Management

- **ATLs are Driven With "Low Level" Commands**
  - Pick From Bin and Move to Tape Drive
  - Status Provided Back Through Sensors
  - Electrical Interface: RS-232C, Ethernet, SCSI-II
  - New Software Interface: SCSI-II, Chapter 16 Jukebox Commands
- **Library Management: Physical Volume Repository**
  - Input PVS and Provide Level of Intelligence
  - Management Resource and Allocation of Bins and Drives
  - Automatic Error Recovery
- **Servers and Applications Provide Next Level**
  - Storage Servers and Bit File/Client Servers
  - Backup

Conclusions

- **Odetics is and Will Be a Major Supplier of Robotic Libraries**
  - Advancing Technologies
- **By Year End, From Broadcast and ATL Products Divisions**
  - Four Different ATL Technologies and Five Products
  - Cross "Breeding" of Technologies Across Divisions
- **In the Future**
  - Broader Reach of Products and Markets Using Robotics
  - Further Transfer of Technologies at Component Levels