

Technology Development for a Standard Cartridge Multi-terabyte Tape System

NIST ATP PROGRAM 70NANB2H3040

3/6/2004



PEREGRINE
RECORDING TECHNOLOGY, INC.

THIC410

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TECHNOLOGY AND STATUS REPORT



MAJOR PARTICIPANTS:

PARTNERS

Accutronics (Transports/Actuators)

Advanced MicroSystems (Wafers)

Advanced Research Corporation (SW Hds./Hd. Fabr.)

Imation (Media/Data Channel/System Integration)

Peregrine Recording (Program Mgmt.)

MAJOR SUBCONTRACTORS

CMU (DSSC) (Media/Modeling/Guiding/ECC)

UCSD (CMRR) (Electro-chemical Tribology)

OSU(NLIM) (Wear/Guiding/Edges)

Mountain Engineering II (MEII) (Transport Test & Integration/Servo Channel)



Performance Objectives

- Currently

- 1500 tpi
- 125 kbps
- **150-200 Mb/in²**
- 3600 Layers/in
- **0.04 TB/in³**

- Goal

- ~50,000 tpi
- 300+ kbps
- **15+ Gb/in²**
- ~5000 Layers/in
- ~**10 TB/in³**

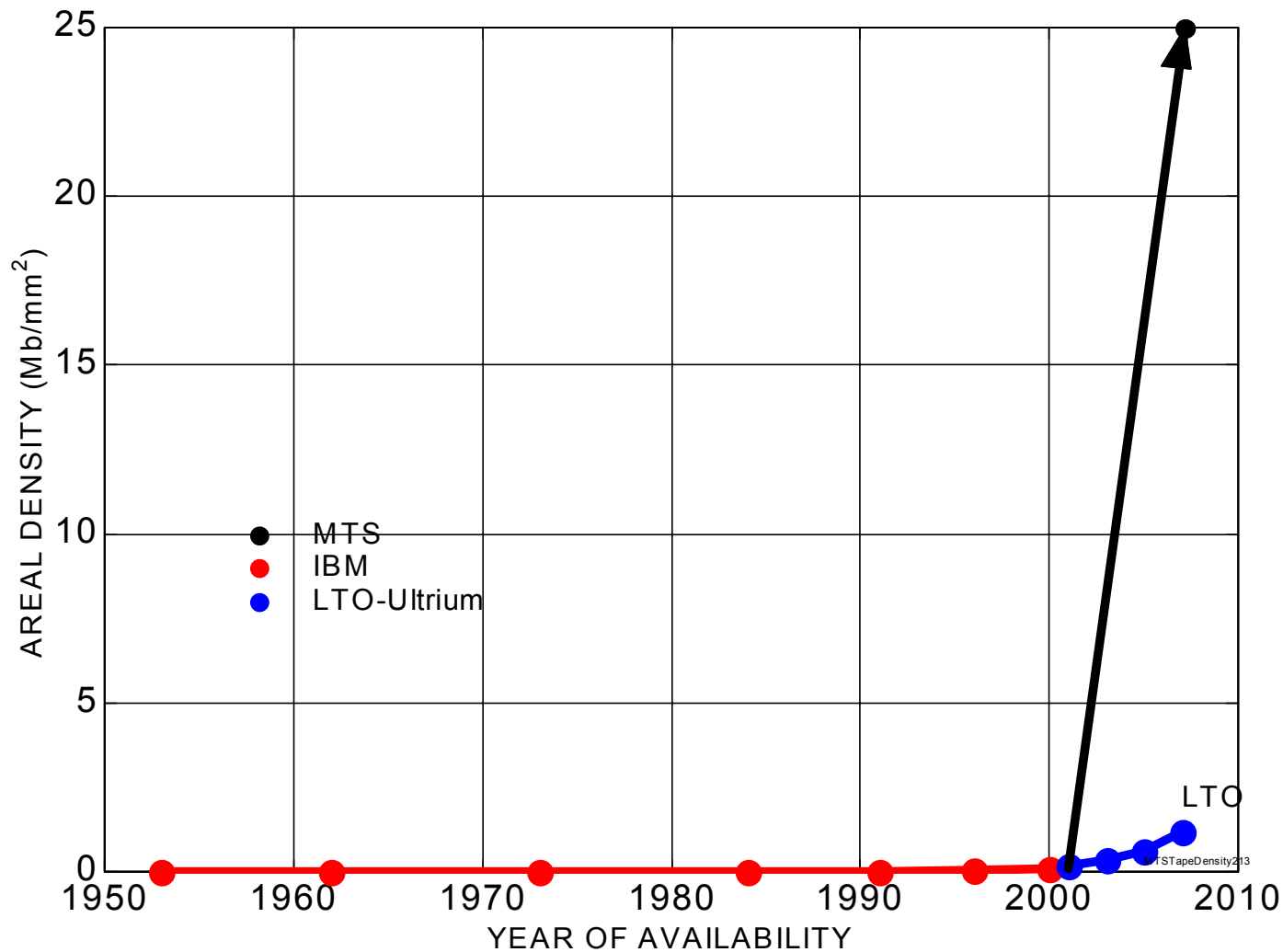


Mechanism

- Large Stable Laboratory Transport
- 10 m/sec
- 16 Channels
- Dual Independent Servoed Heads



Areal Density Comparison



Four Year Program

1 November 2002 – 31 October 2006

Two Phases

Phase I Demo

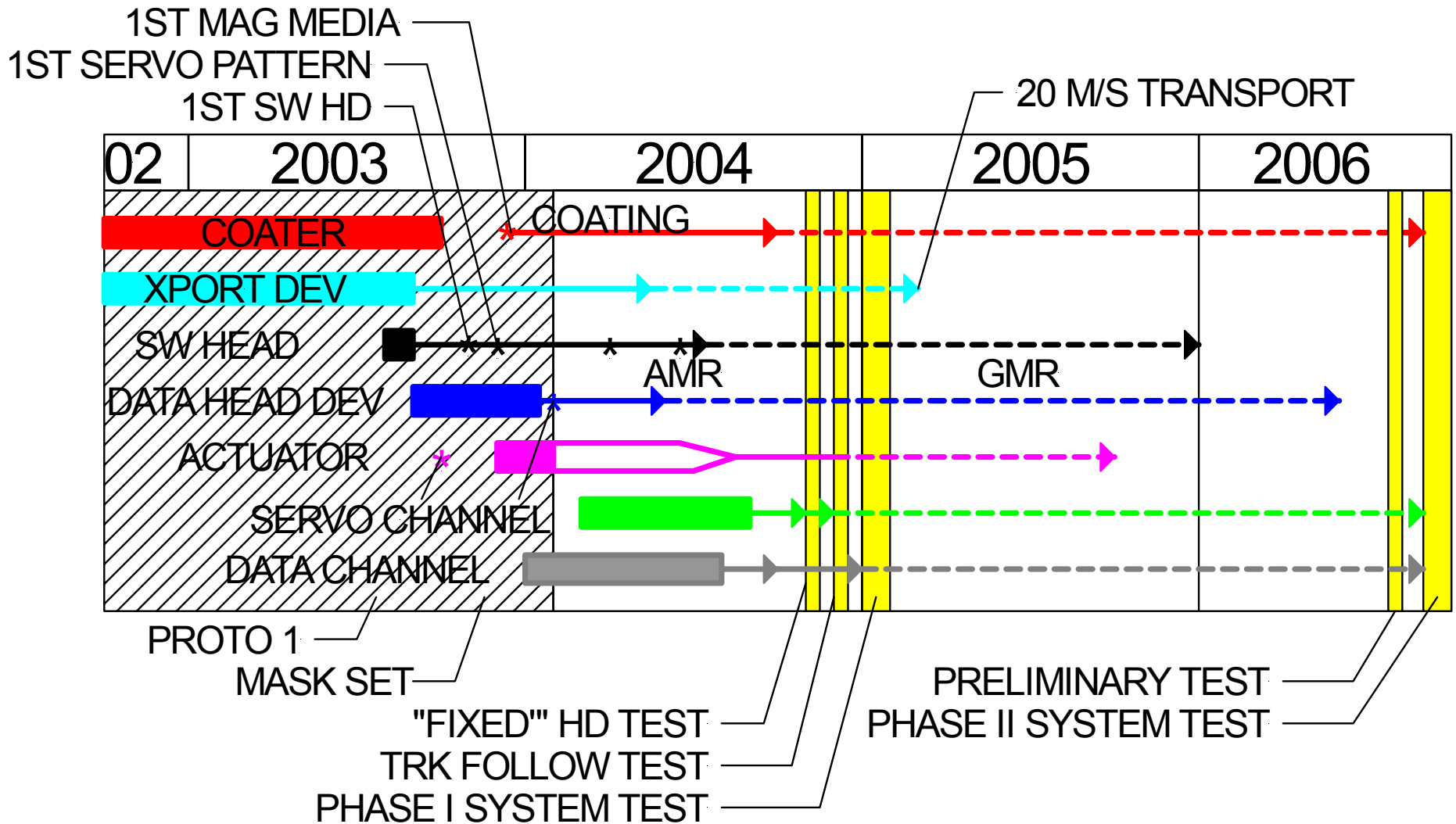
Equivalent 3480 Cart Capacity ~ 5-7GB

Phase II Demo

Equivalent 3480 Cart Capacity~ 25GB



Program Timeline

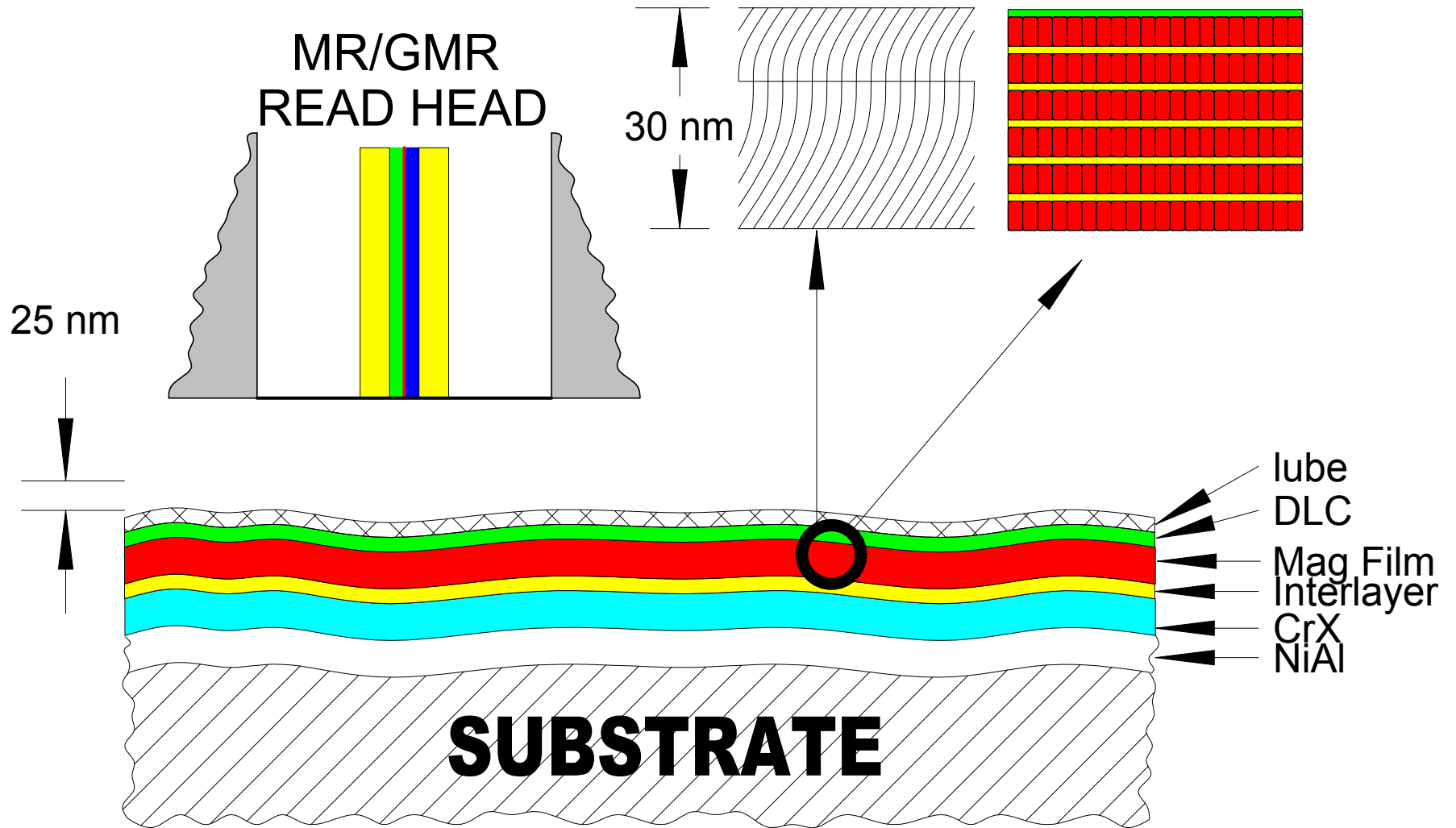


Key Program Elements

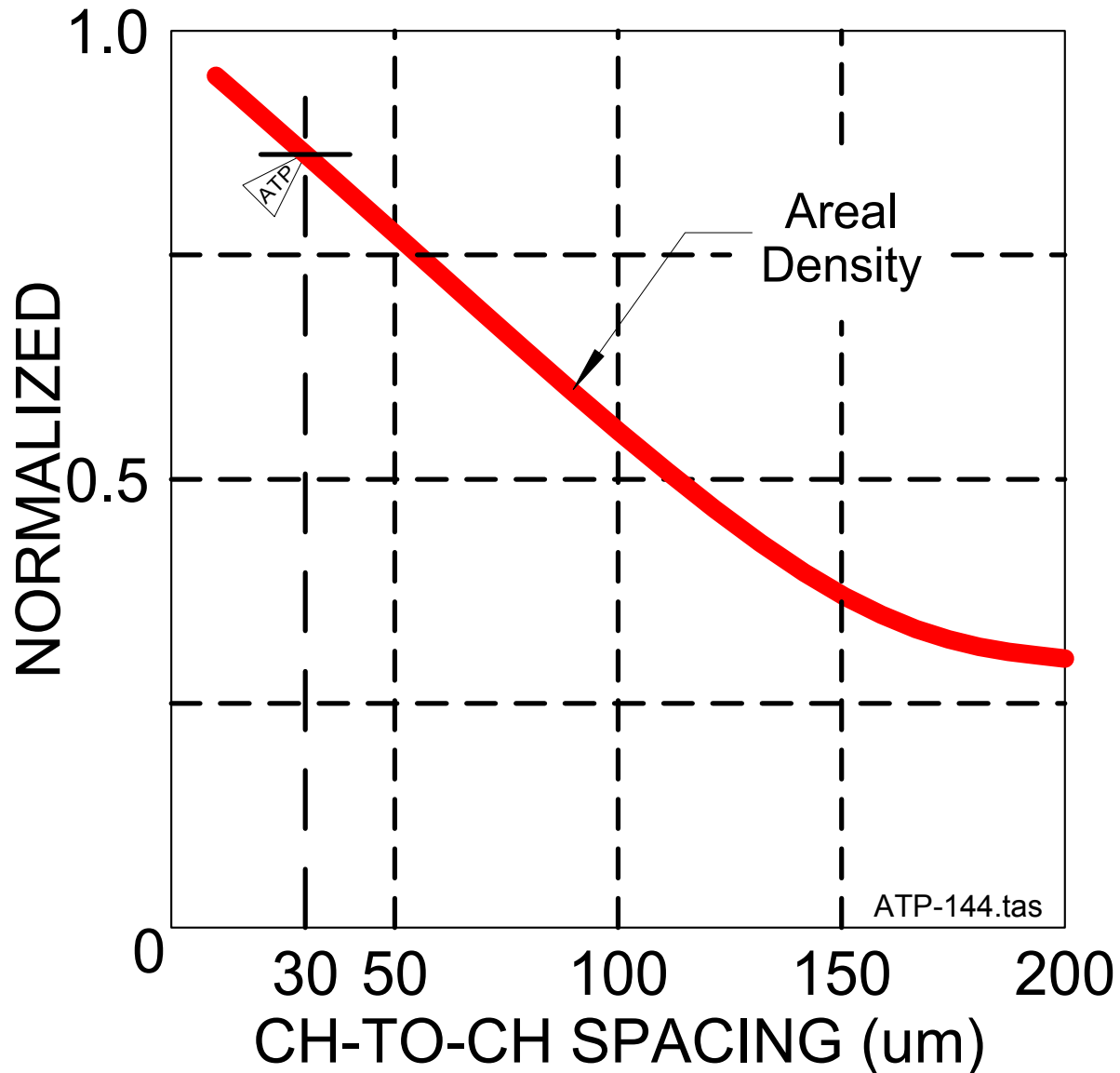
- Sputtered Metal Film Media
- Improved Substrate
- Small Ch.-to-Ch. Spacing multi-element Heads
- Corrosion/wear Resistant GMR Heads
- **LAZR** (**L**arge **A**ngle **aZ**imuth **R**ecording)
- Dual Actuators
- Advanced Data Channel
- Enhanced Tape Guiding



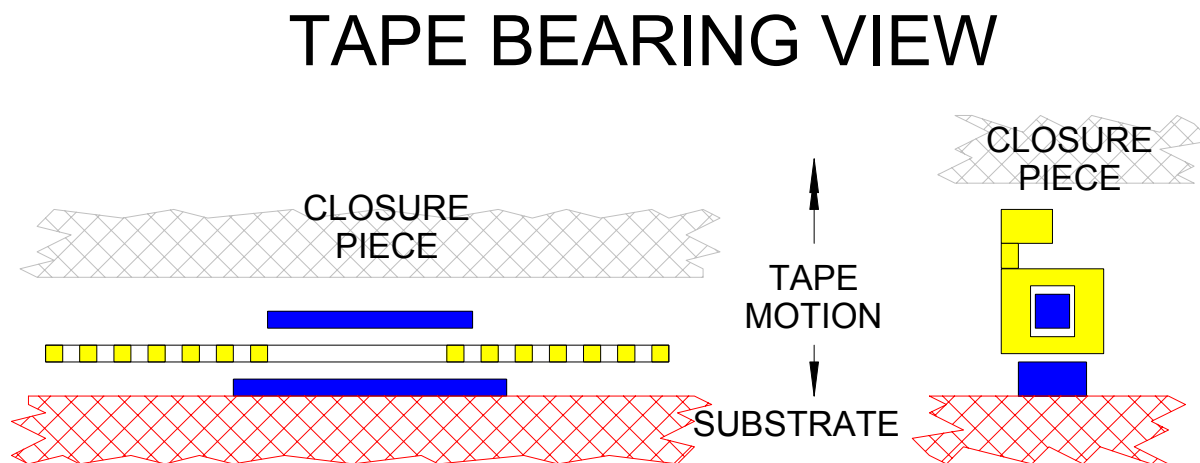
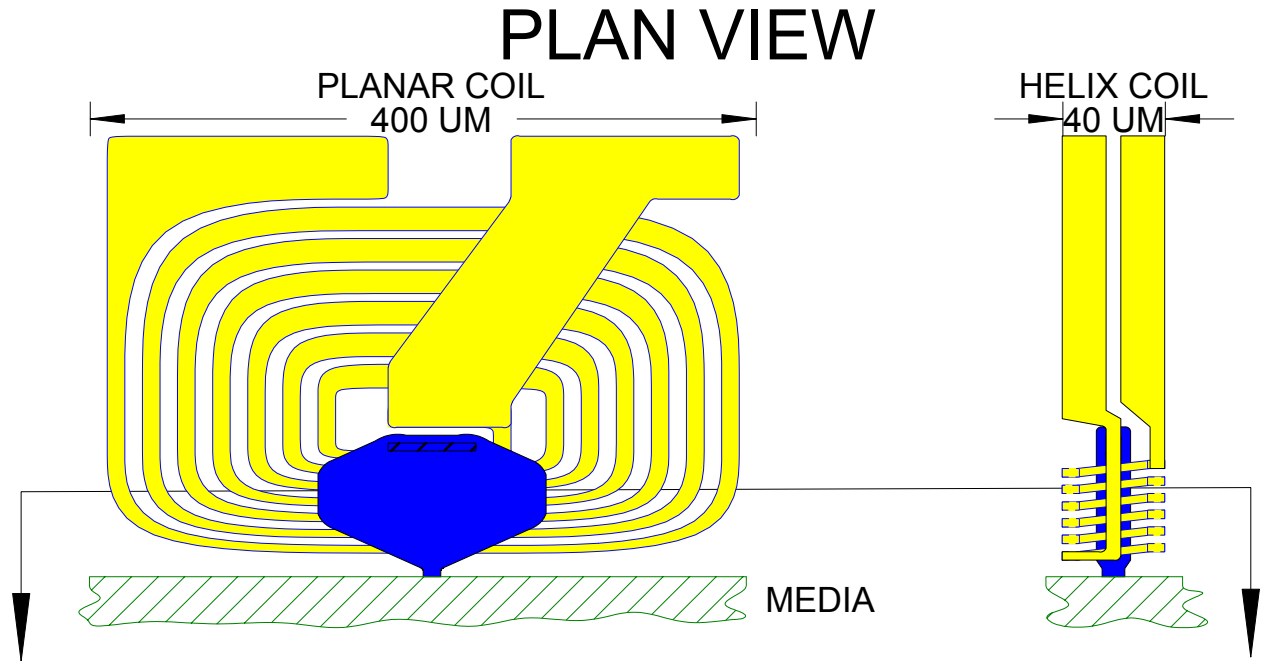
Metal Film



Areal Density vs. Channel Spacing



Reduced Channel Spacing



Corrosion/Wear Resistant GMR Heads

- Improved Head/Media Interface
- Smoother Media
- High Moment Pole Materials (FeX?)
- Low PTR Pole Material & Processing
- Copperless GMR
- Improved Head/Media Environment

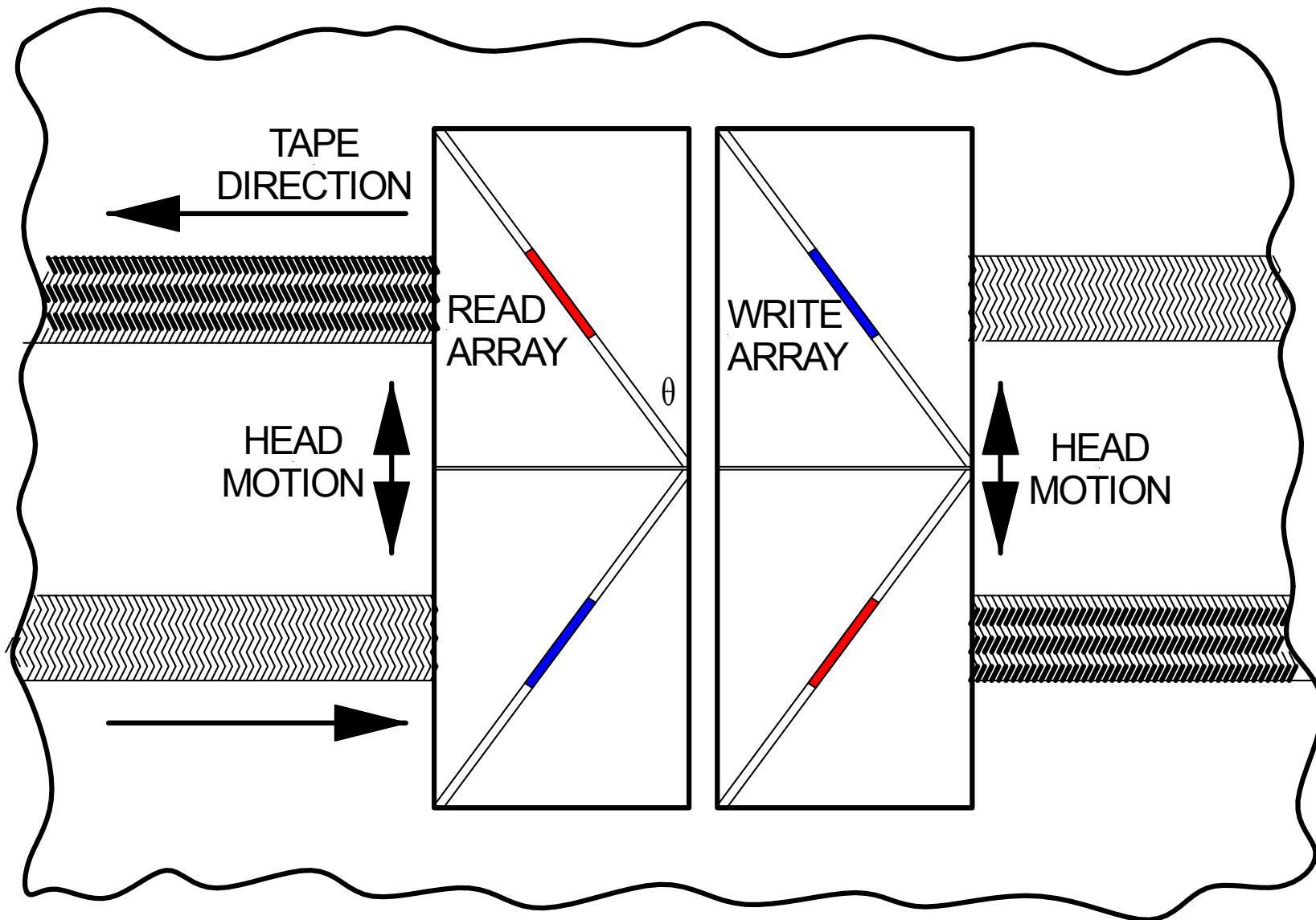


Sources of Tracking Error

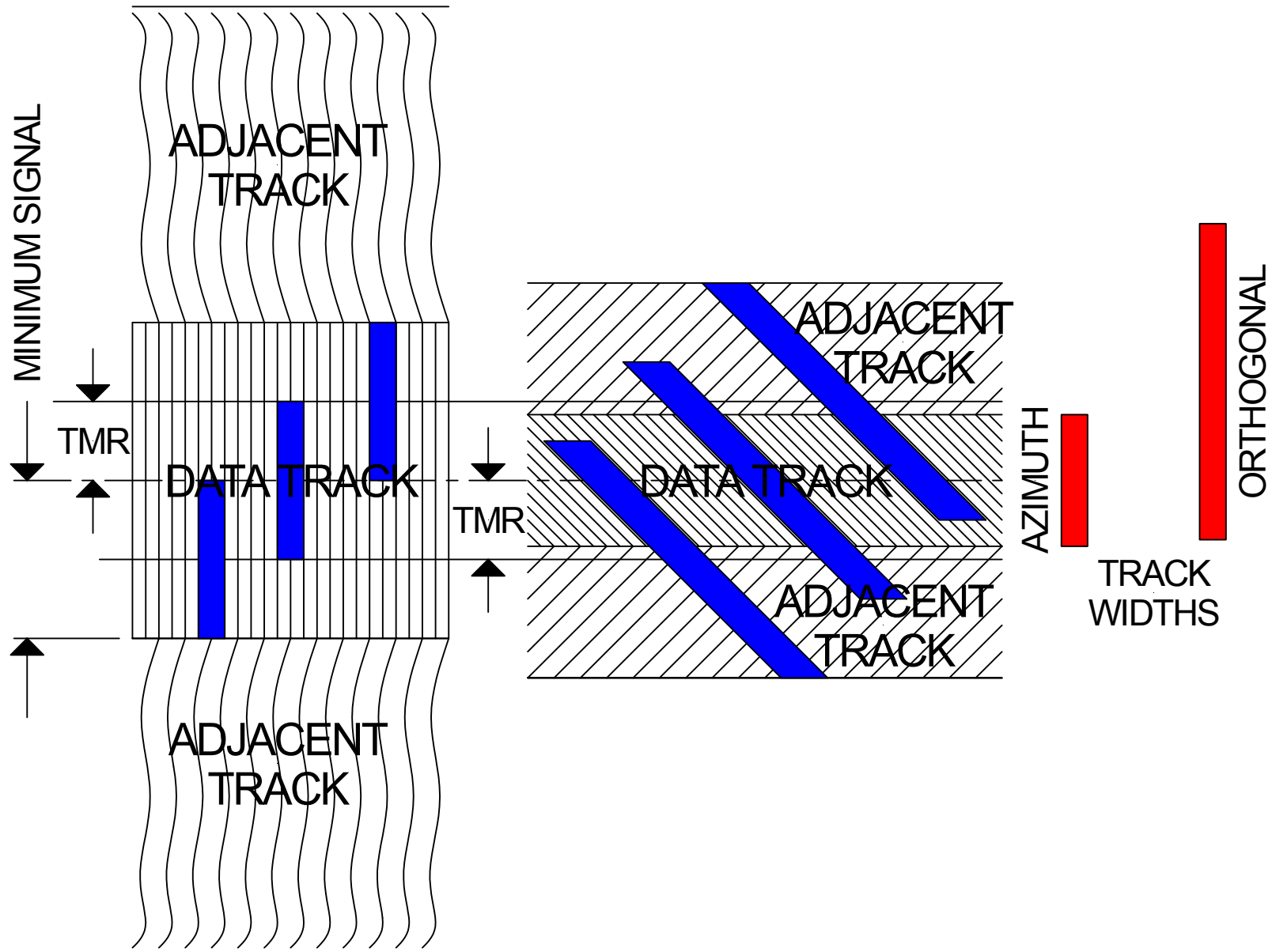
- **Head**
 - Photolithographic Tolerances
 - Assembly Offset
- **Media**
 - Substrate Dimensional Instability
 - Servowriting
- **Drive/Transport**
 - Head Parallelism with Guides
- **Lateral Tape Motion**
 - Tape Edge “Weave”
 - Guiding
 - Vibration



DUAL ACTUATORS

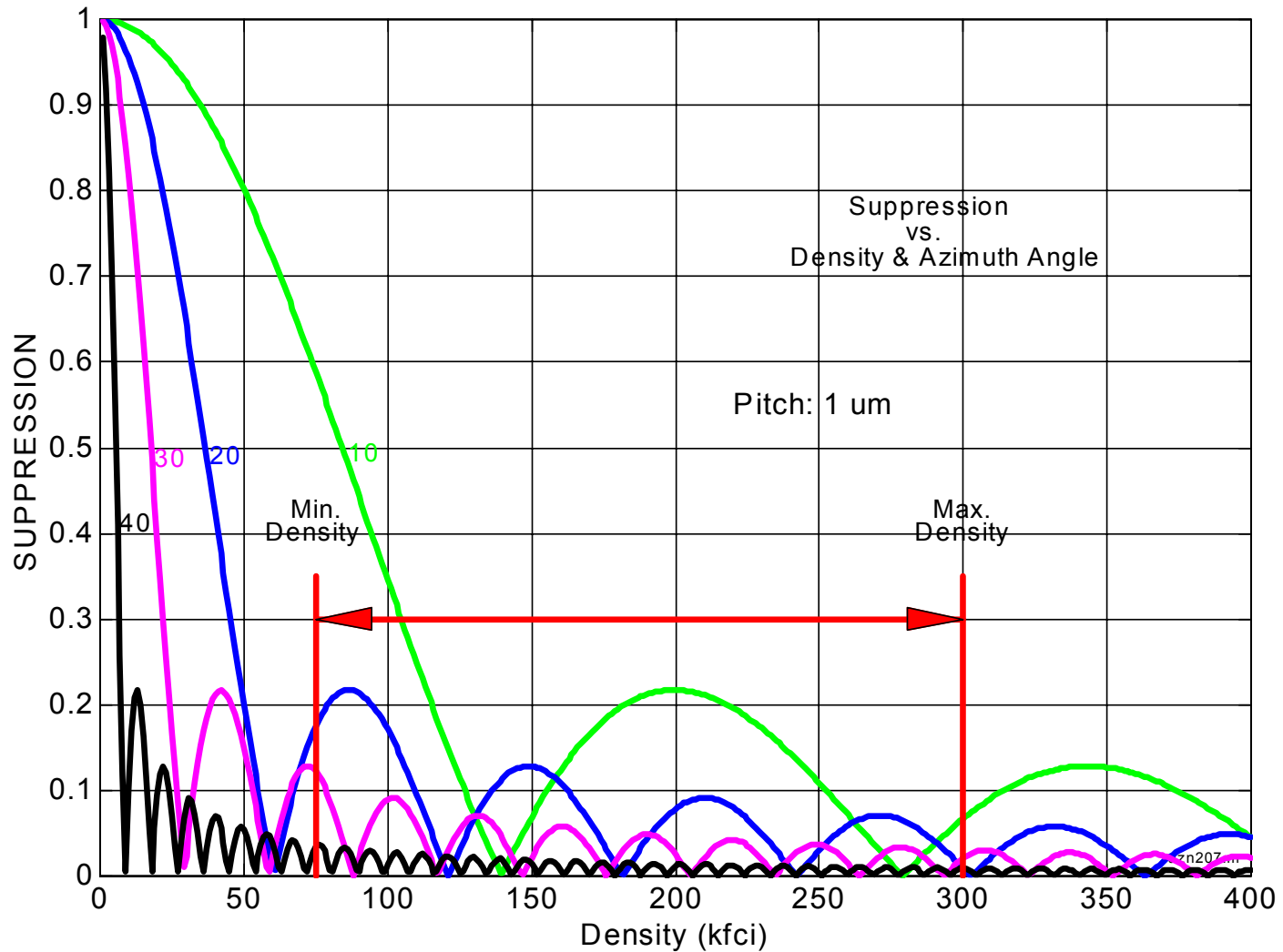


Large Angle Azimuth Recording



Large Angle Azimuth Recording

Azimuth Recording Adjacent Track Suppression



Tape Guiding

- Challenges

- Thinner Substrates
- High Speed
- Tape Wander
- Take-up

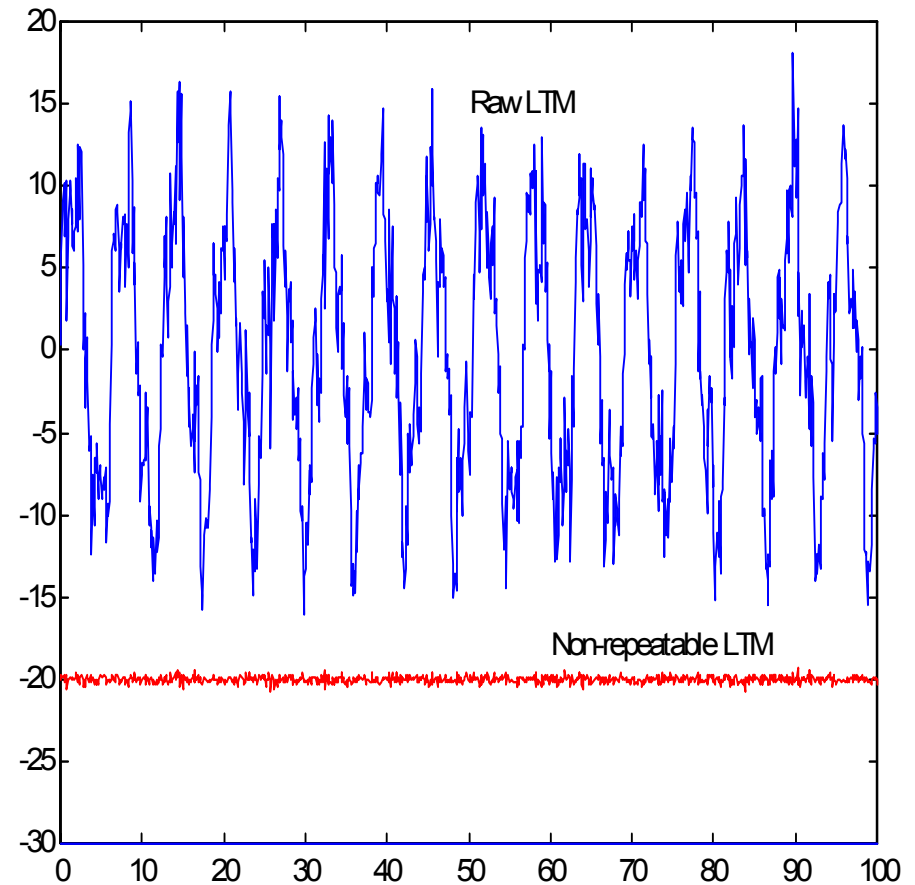
- Approaches

- Long Guides
- Improved Slitting
- Non-Edge Guiding



Lateral Tape Motion (LTM)

- Tape Edge/
- Fotonic Probe
- Commercial Drives
 - 7 μm – 20 μm p-p
- MTS Transport
 - 2 μm – 5 μm p-p
 - **Non-Repeatable**
 - **0.1 μm – 0.2 μm p-p**



Advanced Data Channel

- High Data Rate ~ 1.9 Gb/sec
 \sim **7 Hours**(@ 50 % efficiency.)
- High-Gain Encoding
- Low Density Parity Code (LDPC)
Error Correction



Progress To Date:

•AI/MEII

- Delivers Tape Transports
- Delivers Version 2 Air Bearing Actuator

•AMS Joins Program

- Head Masks Completed – Heads in Wafer Fab.

•ARC

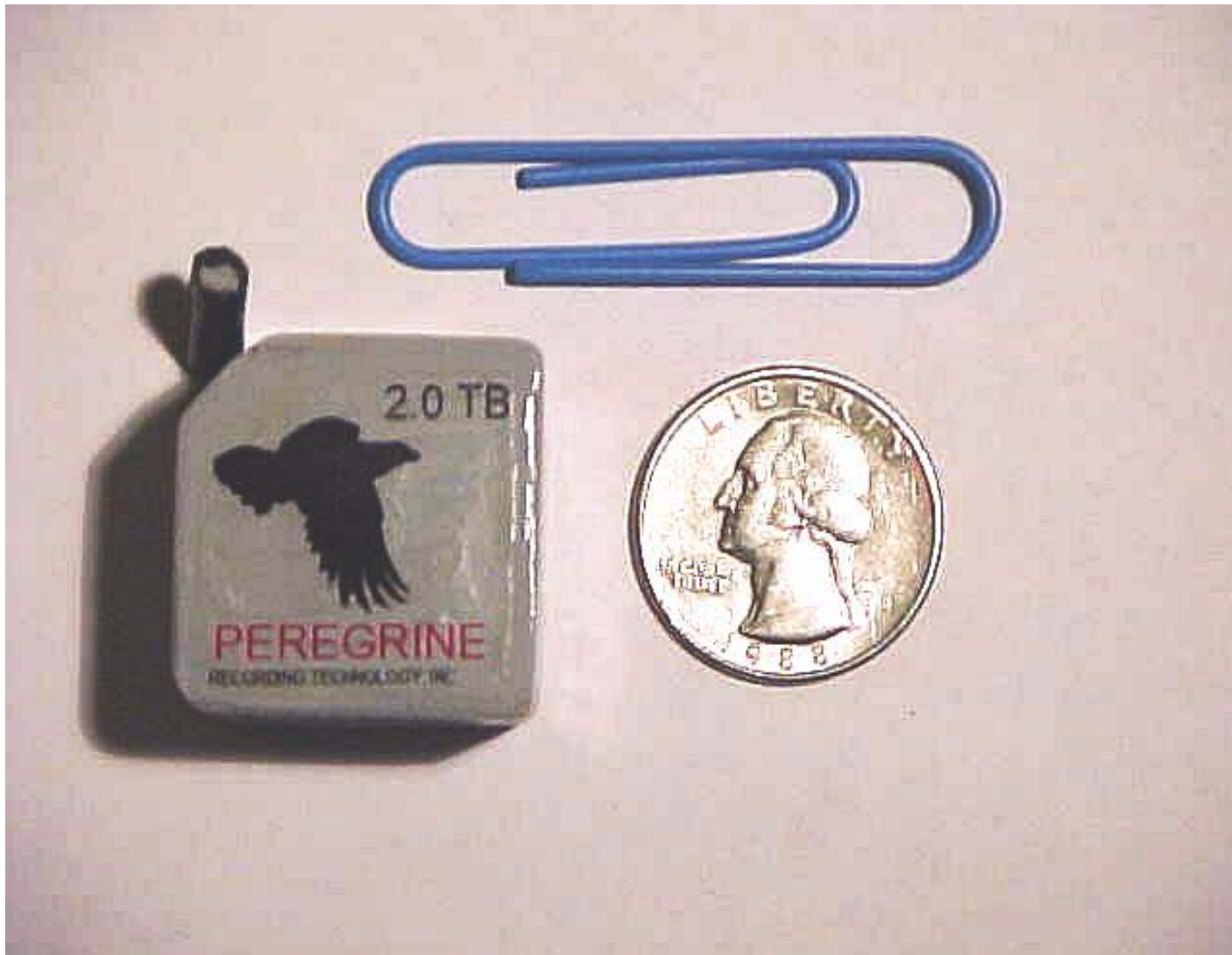
- Fabricates Servowriter head and records servo pattern
- Receives and Certifies “Back-end” Head Fabrication Equipment

•IMN

- Sputtered Metal Film Coater Installed and Running
- 1st Magnetic Films with “Good” Magnetic Properties Fabricated
- 2nd Set of Targets Received
- DLC and Lube Coater Built and Installed
- Evaluation Channel Electronics Installed on 1st Transports



Tomorrow



PEREGRINE
RECORDING TECHNOLOGY, INC.

END

