

Figure 1.

# Areal Density Roadmap

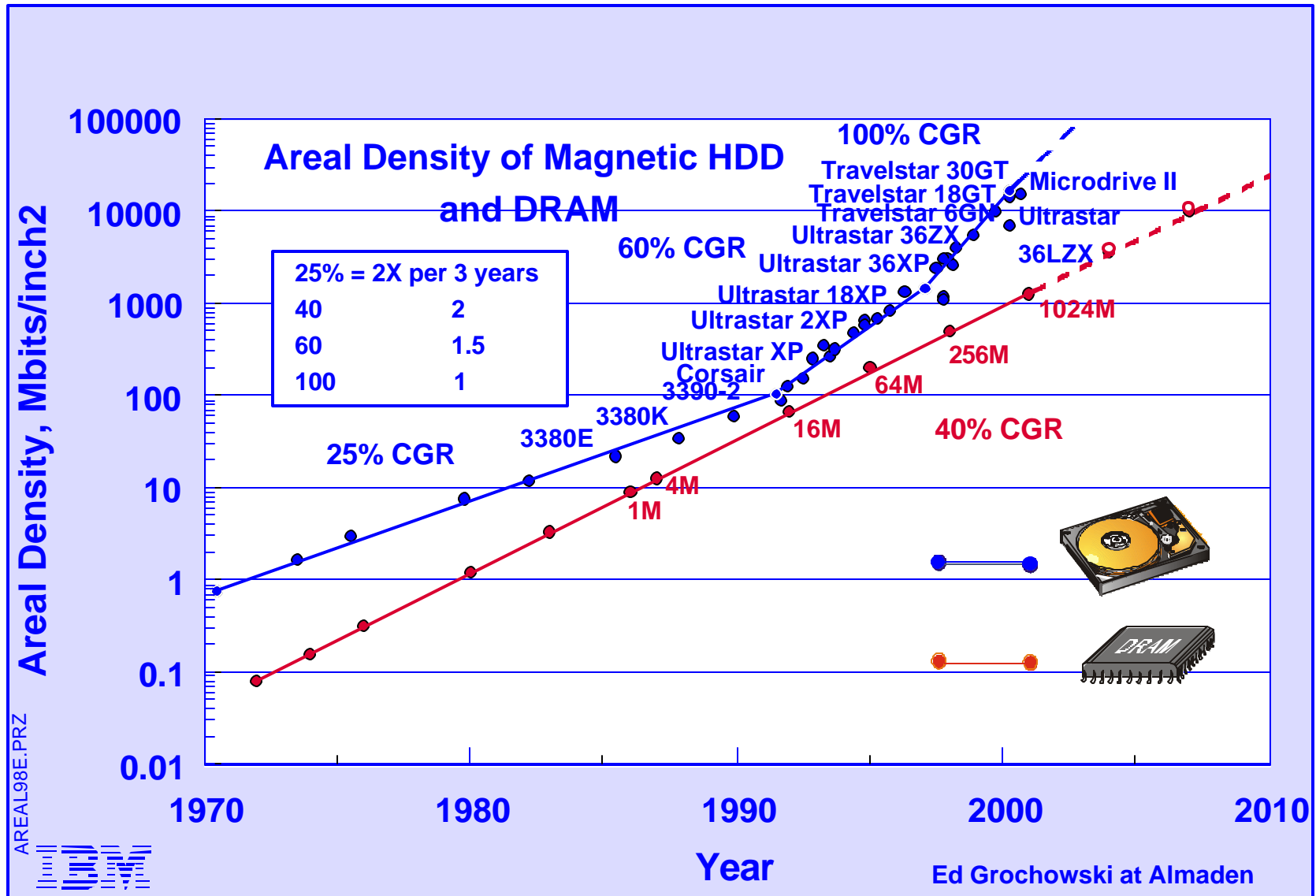


Figure 2.

# Trends in Price of Storage/MB

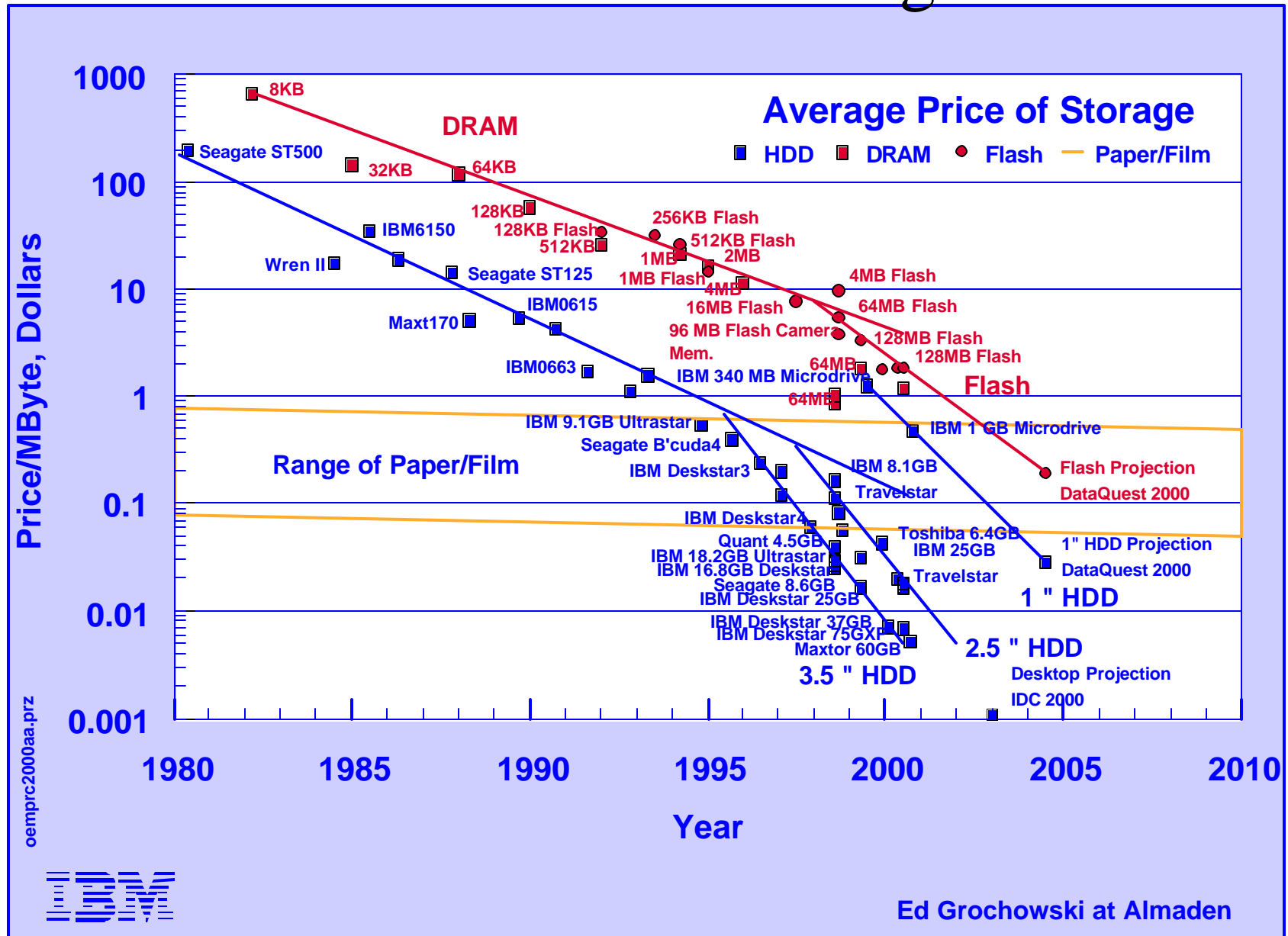
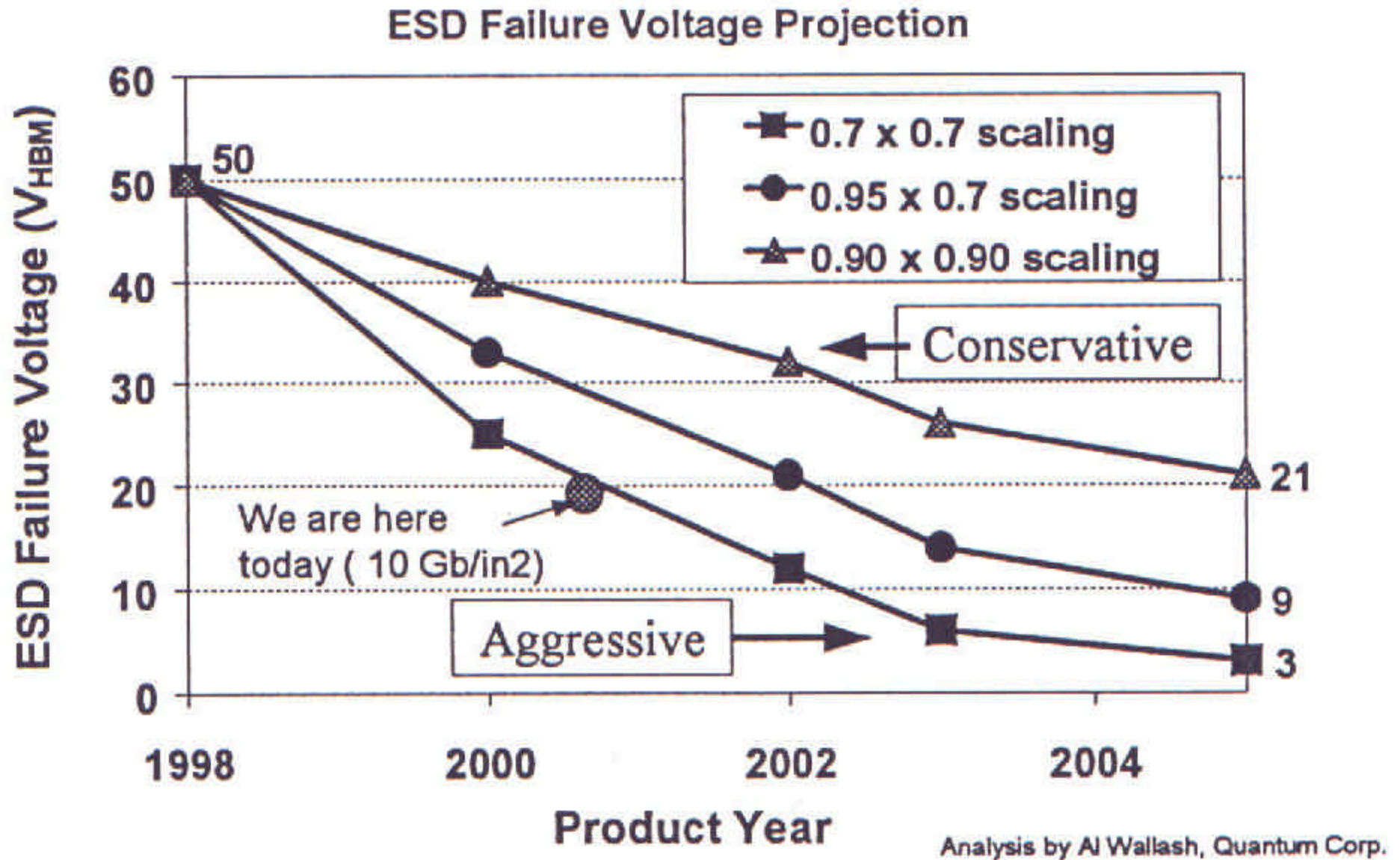


Figure 3



Source: S. Lambert of Quantum, Drive Integration Challenges in Head/Media Testing, NSIC Manufacturing Symposium 2000.

Figure 4.

## Hutchinson Technology Secondary Actuator Suspension

### Reverse Standard Base

- Back to back clearance
- Allows for trace routing flexibility
- Reduced boss tower heights

### 14.5 mm Part Length

- Higher performance (dynamics) part format
- > 6.2 kHz primary off-track mode

### Parallel PZT Motors

- Orientation enhances stroke sensitivity
- Stiffens lateral suspension modes
- Conductive adhesive attach

### Gold Wire Stitch

- Single, continuous wire
- Single-ended motor architecture

### TSA Flexure

- Ball bond termination
- Accommodates head polarity variants
- Common datum structure with load beam

### 0.1 mm (4 mil) Load Beam

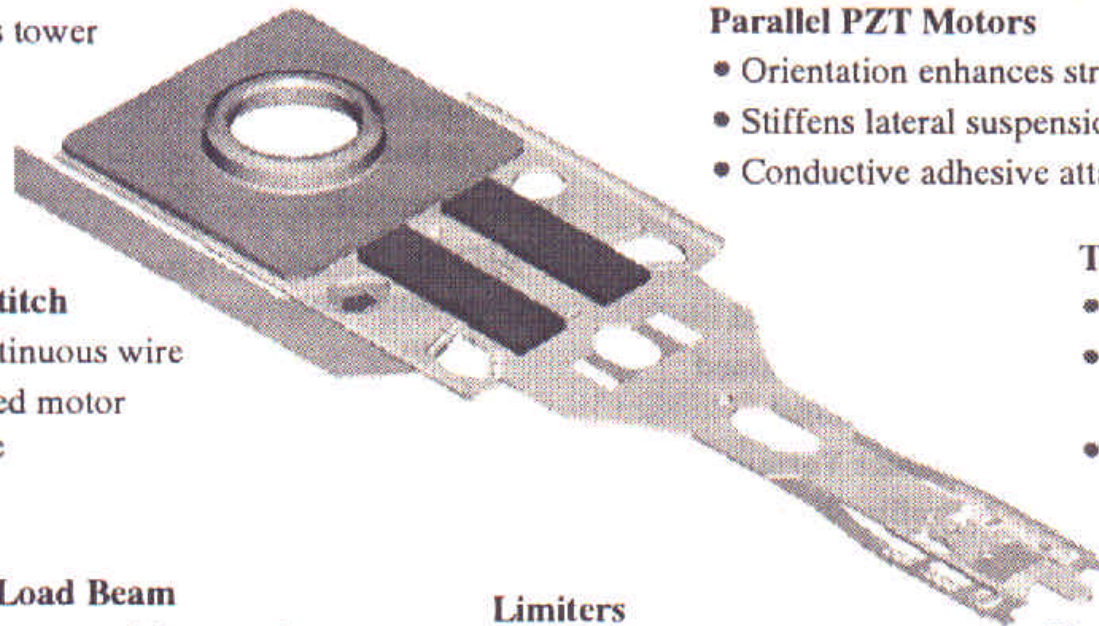
- High load beam natural frequencies
- Better aspect ratio for motor webs
- Formed rails in base and head regions
- HGA/HSA clocking / tooling features

### Limiters

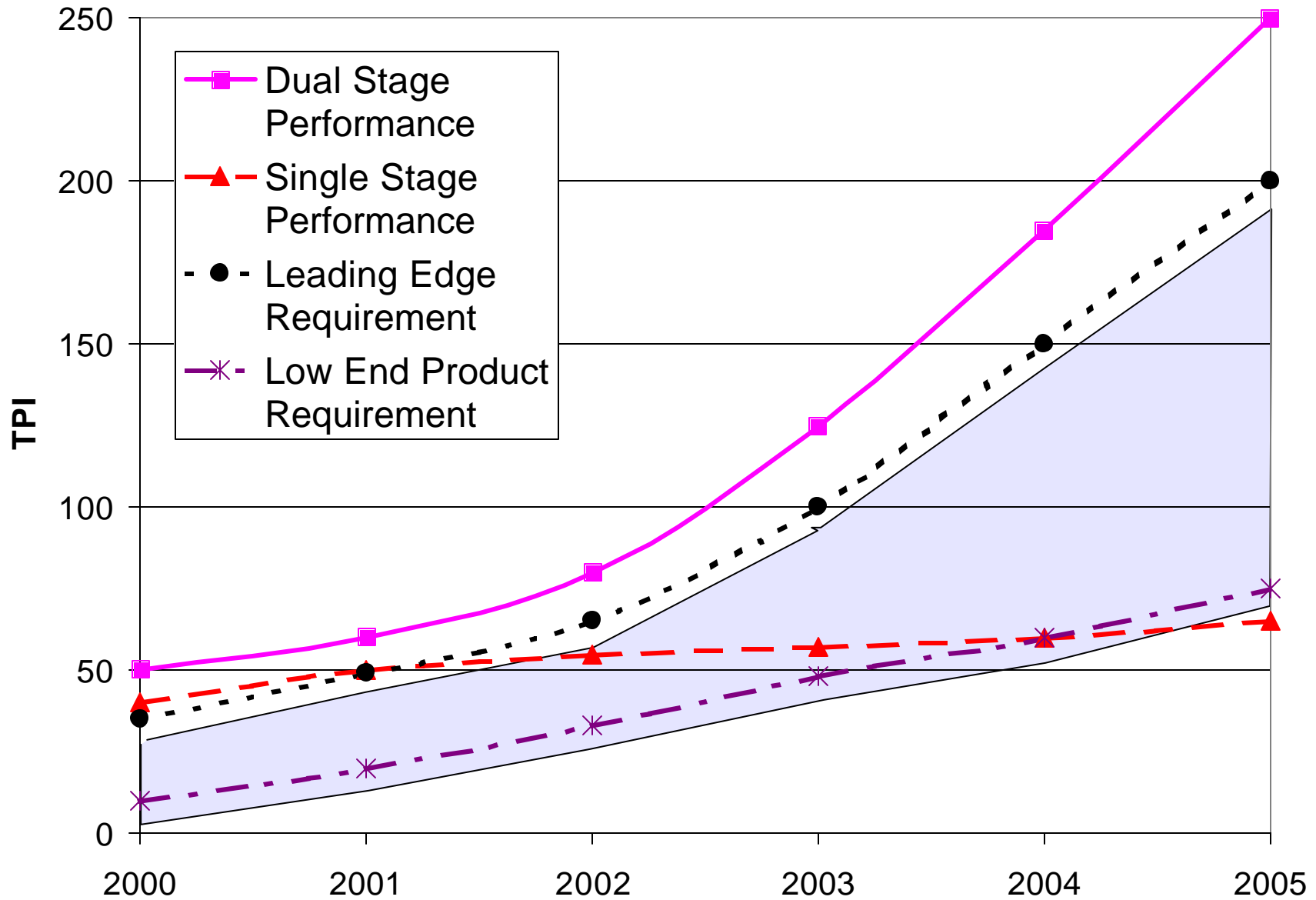
- Shock liftoff control
- Dynamic load/unload

### Head Lift

- Formed and cupped dimple



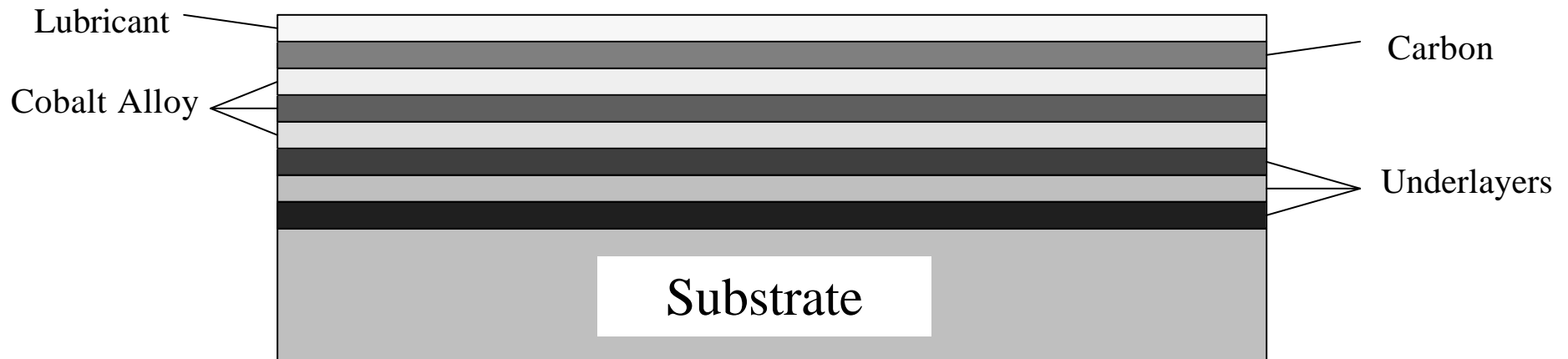
# Figure 5. TPI Requirements and Implementation of Suspension Secondary Actuators



Source: K. Hayakawa of HTI, Suspension Progression for High Servo Bandwidth, Diskcon Japan 2000.

Figure 6.

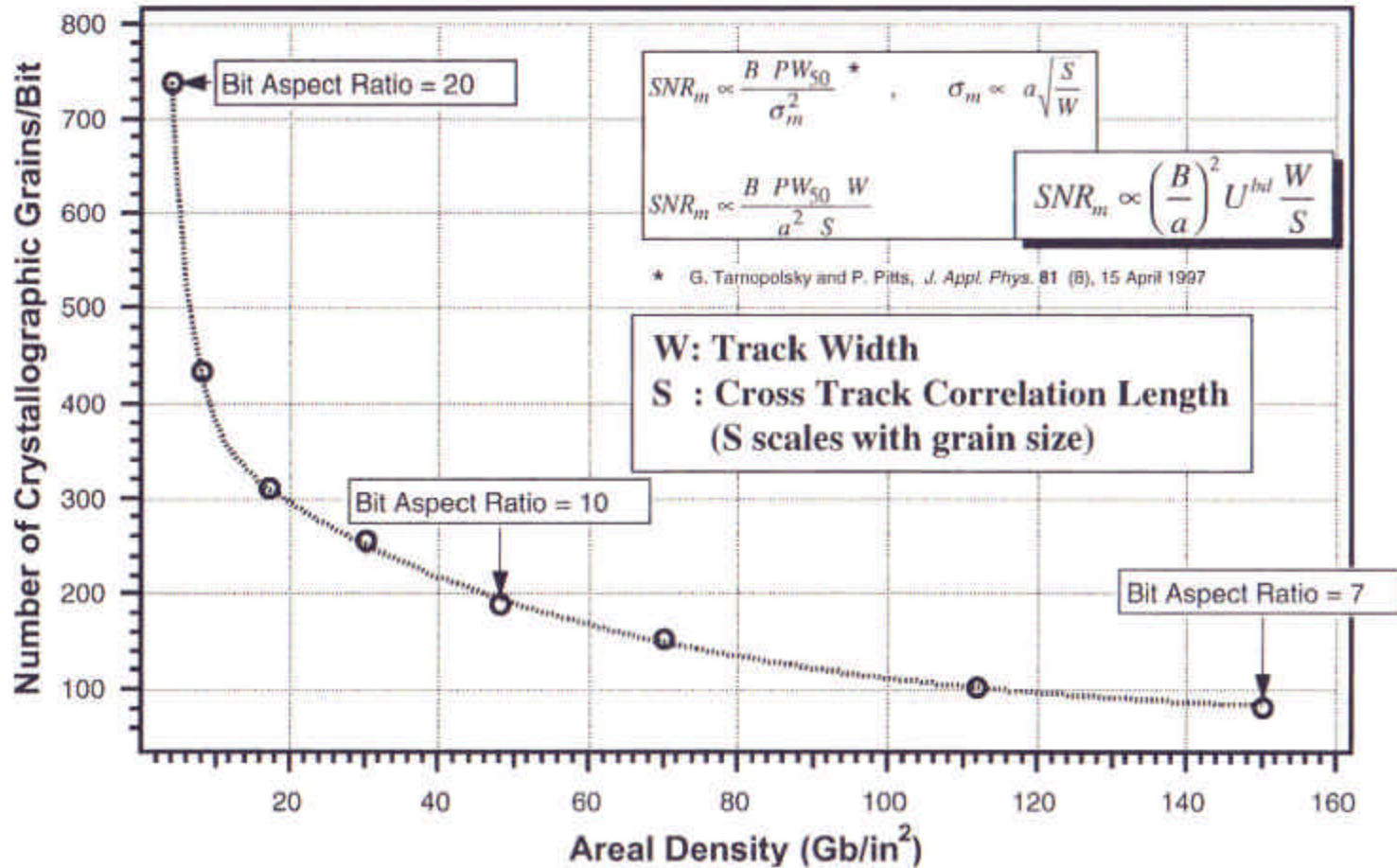
# 2000 Recording Medium



- Substrate: 95mm diameter X 1.27mm thick Aluminum alloy or 65mm/85mm Glass
- 2-3 Underlayers: NiAl, Cr, CoCr or CrX
- 2-3Magnetic Layers:  $\text{Co}_v\text{Cr}_w\text{Ta}_x\text{Pt}_y\text{B}_z$
- Carbon: Diamond Like Carbon, 3.0 nm
- Lubricant: 1.0-1.5 nm “dipped” fluorocarbon lubricant

Figure 7.

### Media Grains per Bit Vs. Areal Density



Sept. 20, 2000/G. Bertero

Diskcon USA 2000

KOMAG

Source: G. Bertero of Komag, The Path to 100 Gb/in<sup>2</sup> Media, Diskcon 2000

Figure 8.

# Magnetic Spacing Trends

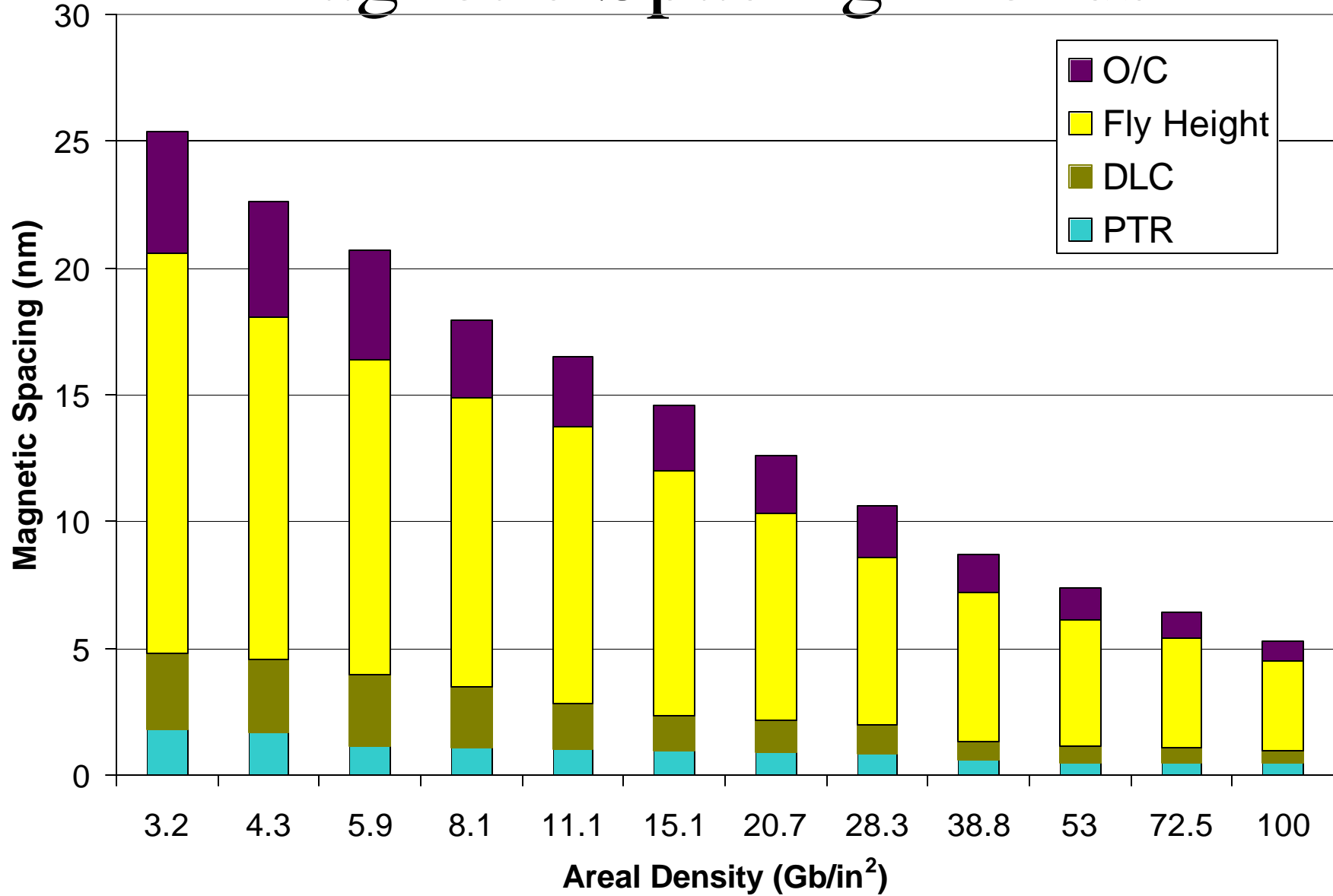
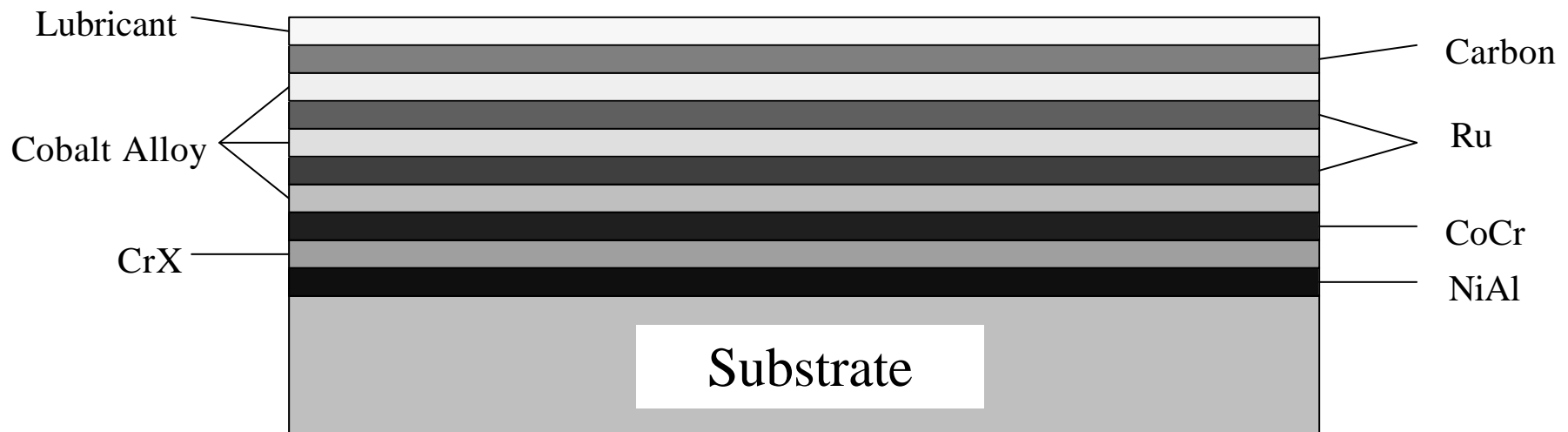




Figure 9.

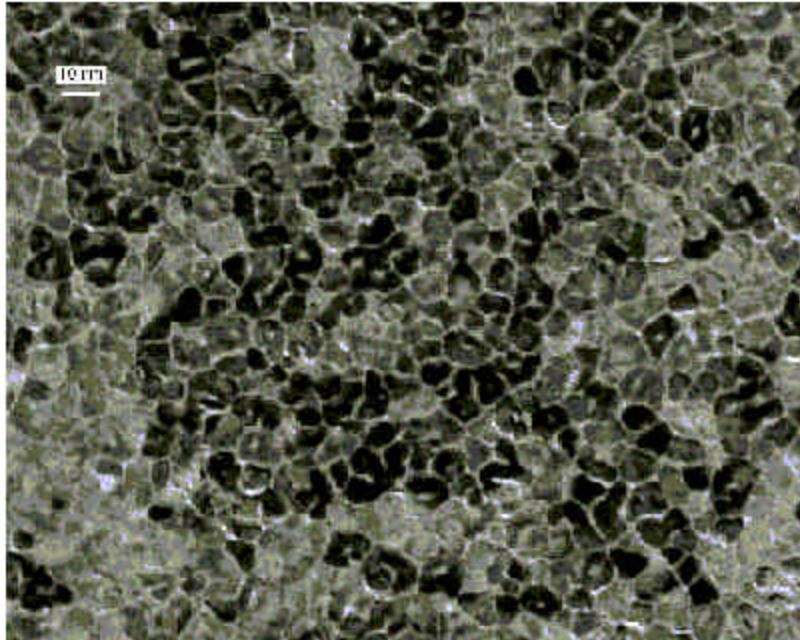
# Synthetic Antiferromagnetic Recording Medium



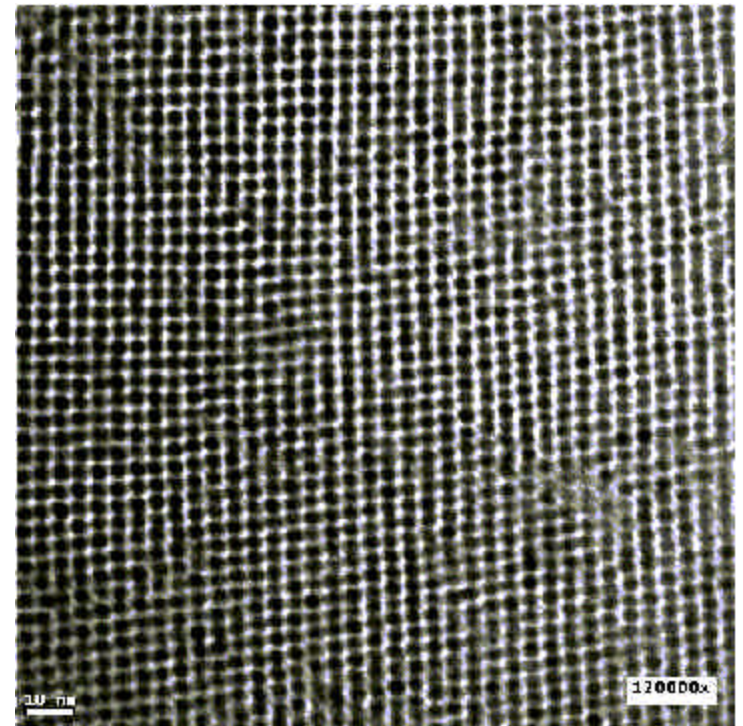
- 2-3 Underlayers: NiAl, Cr, CoCr or CrX
- 2-3 Magnetic Layers:  $\text{Co}_v\text{Cr}_w\text{Ta}_x\text{Pt}_y\text{B}_z$
- 1-2 Antiferromagnetic Layers: Ru
- Carbon: Diamond Like Carbon, 3.0 nm
- Lubricant: 1.0 nm vapor deposited lubricant

Figure 10.

## Comparison of Thin Film Media Grains and Nanoparticle Film Grains



35 Gb/in<sup>2</sup> CoPtCrB Medium



4 nm FePt Particles

Figure 11.  
**Enterprise HDD RPM Projections**

Source: DataQuest and Projection to 20+k RPM

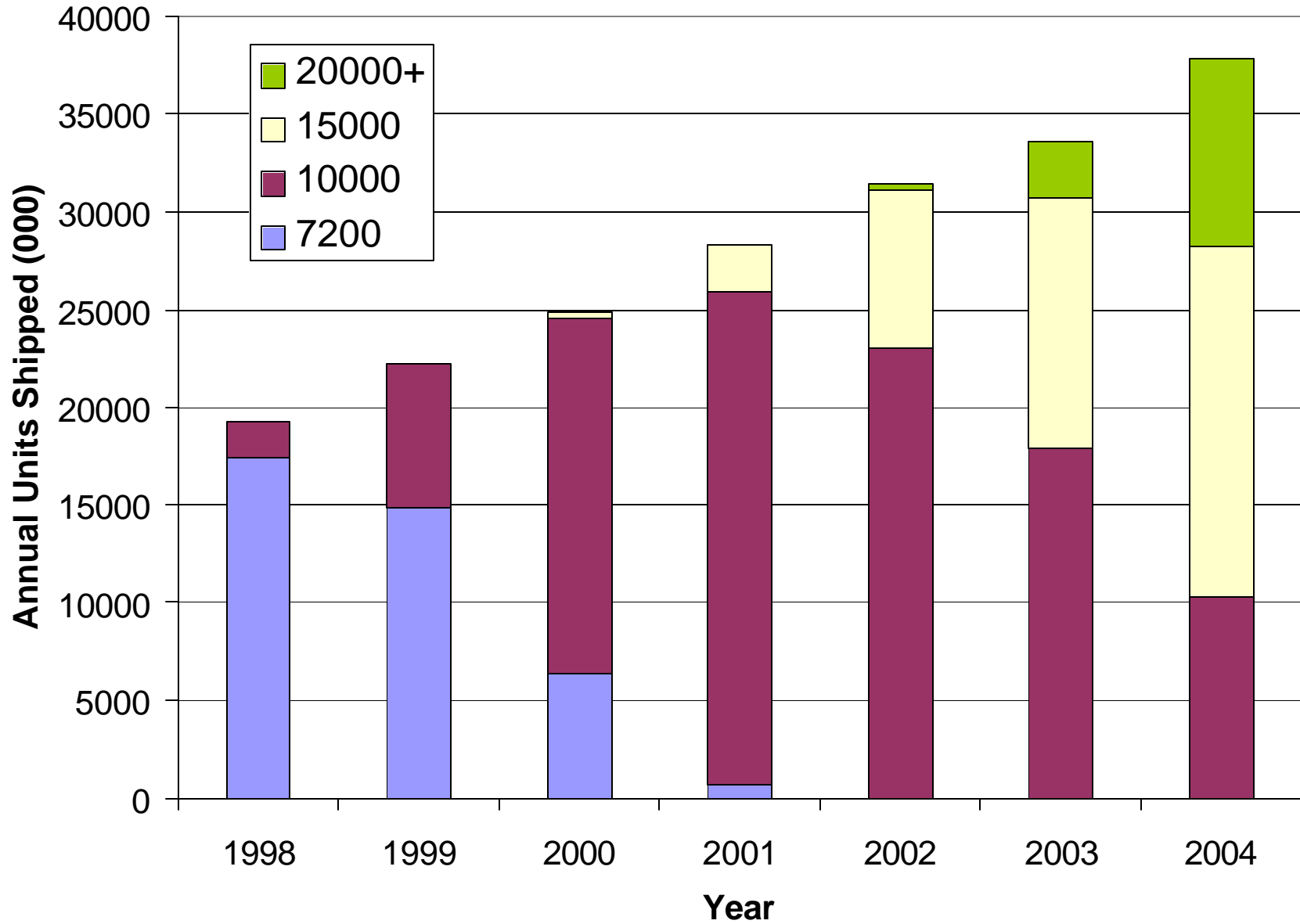
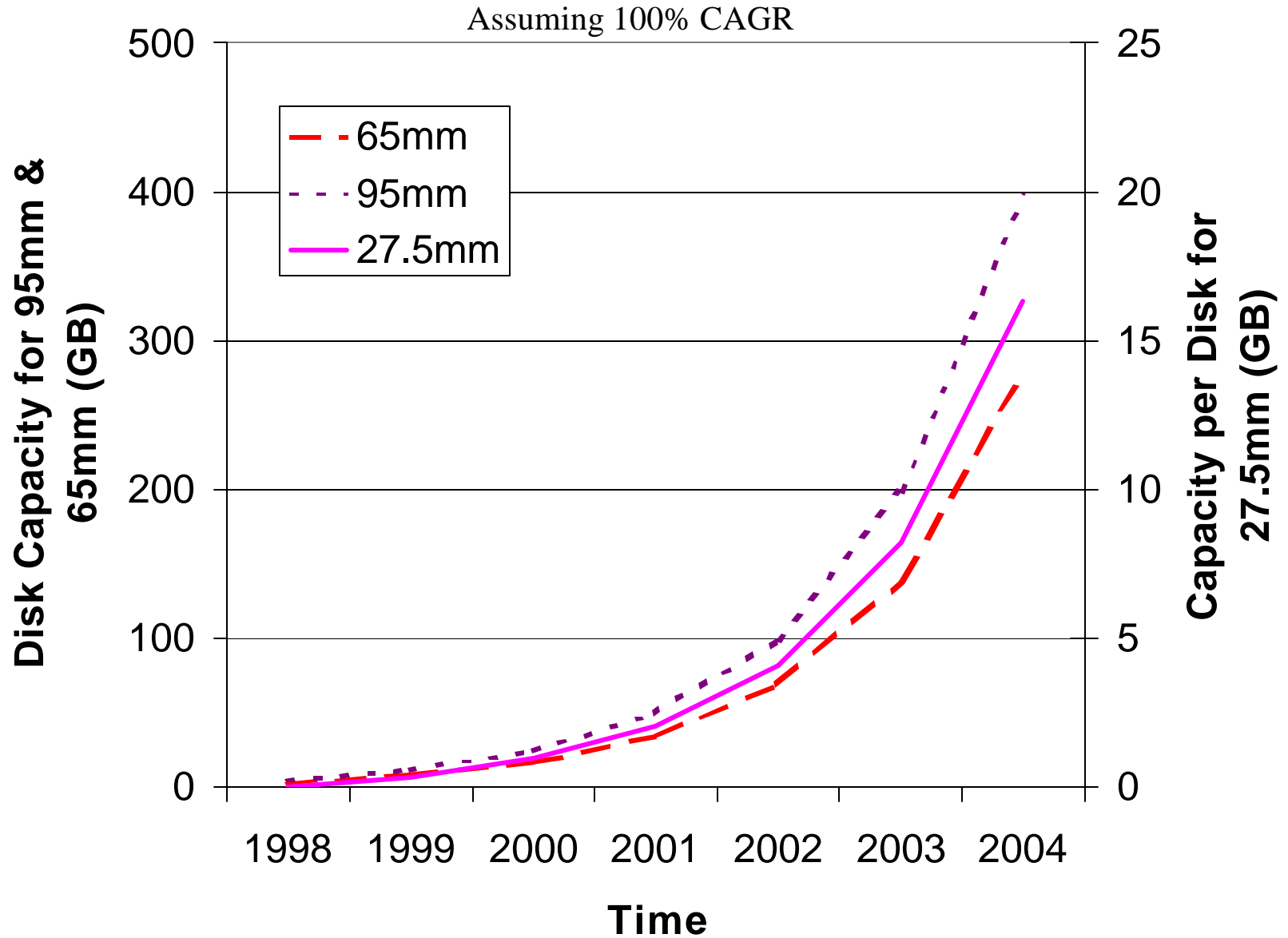
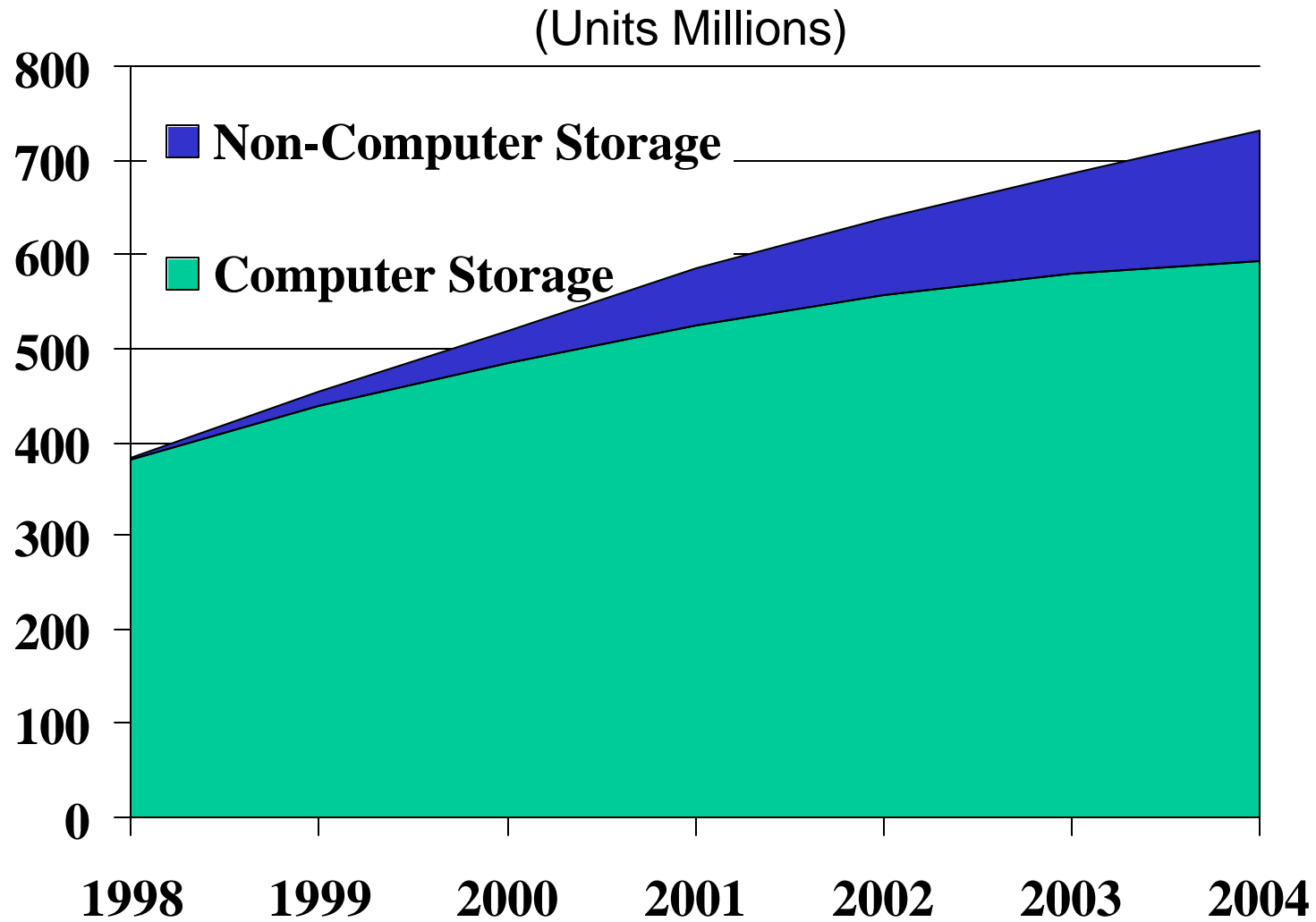


Figure 12. **Per Disk Capacity vs. Form Factor Forecast  
(100% per Year Areal Density Increase)**



**Figure 13.**  
**Computer Storage / Non-Computer Storage Markets**



Source: Peripheral Research Corp, 2000.