Heat and Drive

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Where Does Power Go?

Spindle Motor (SPM)

Voice-Coil Motor (VCM)
Temperature Affects Disk Drive Reliability

- Heat-Related Problems
  - Data corruption
  - Higher off-track errors
  - Head-crashes
- Hard disk operating 5 C above normal temperature 10-15% more likely to fail

Disk drive design constrained by the thermal-envelope
- Puts a limit on drive performance

**Thermal-Constrained Design**

\[ \text{Data Rate} \approx (\text{Linear-Density}) \times (\text{RPM}) \times (\text{Diameter}) \]

- **Data-Rate**
- **Capacity**
- **Temperature**

**40% Annual IDR Growth**

**Increase RPM**
- **Lower Data Rate**
- **Shrink Platter**

**Drive Temperature**

![Drive Temperature Graph](image)