

# Trends In Reliable Storage

A Guide to the Intelligent Buyer

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The background features several sets of concentric circles in a lighter shade of blue, resembling ripples in water, scattered across the lower half of the slide.

# Future Trends

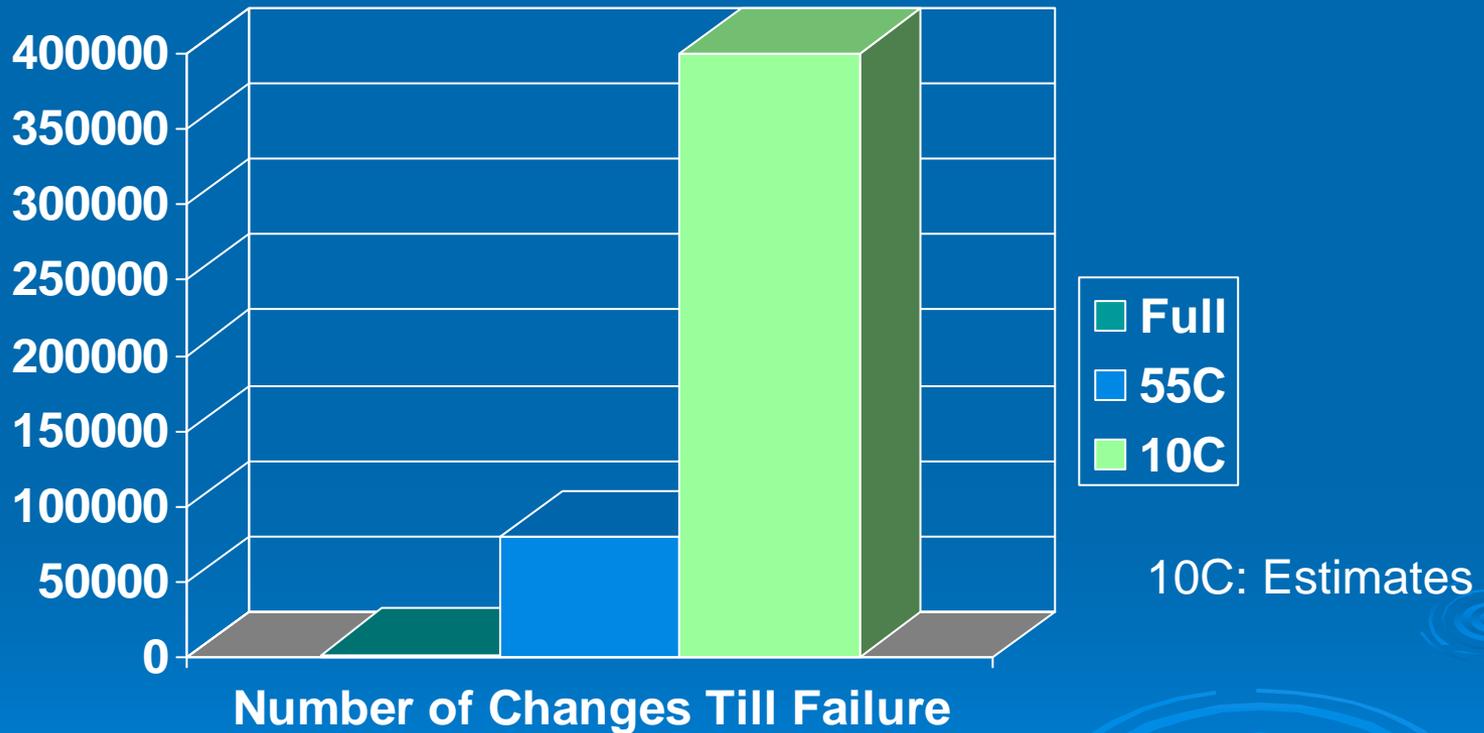
- Interaction with power
- System & problem size
- Hardware trends in soft errors



# Power Management and Reliability

- You will have power management
- Power management will create thermal variations that will induce mechanical stresses at chip and board levels
  - Storage controller may be affected
  - **Do you know what is in your storage controller?**
- Disk reliability may be affected:
  - Longevity of disks inversely proportional to the number of power cycles
    - Disks designed to sustain a power on-off cycle every **8 hours** (Seagate)
    - Each power on-off is estimated to cut the life of a disk by **10 hours** (Google)
  - Varying the motor speed induces mechanical stresses
  - No models or understanding of the effect on reliability exists

# Effect of Thermal Cycles



Power management is useful, but if done carelessly it can impact reliability  
Need: Temperature and reliability-aware power management algorithms

# Future Trends: Problem Size

- Indirect but powerful: Storage density growth struggling to catch up with demand
  - Larger systems will have far more components (controllers and disks....)
  - MTBF will go down



# Future Trends: Soft Error Rates

## ACCELERATED TESTING

### Th Foil Fail Rate Bulk Devices

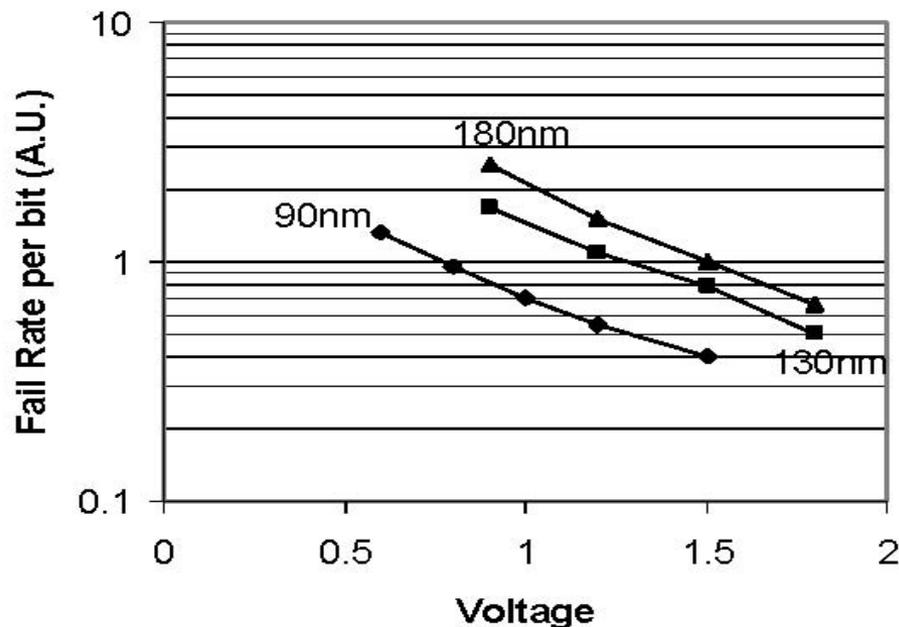


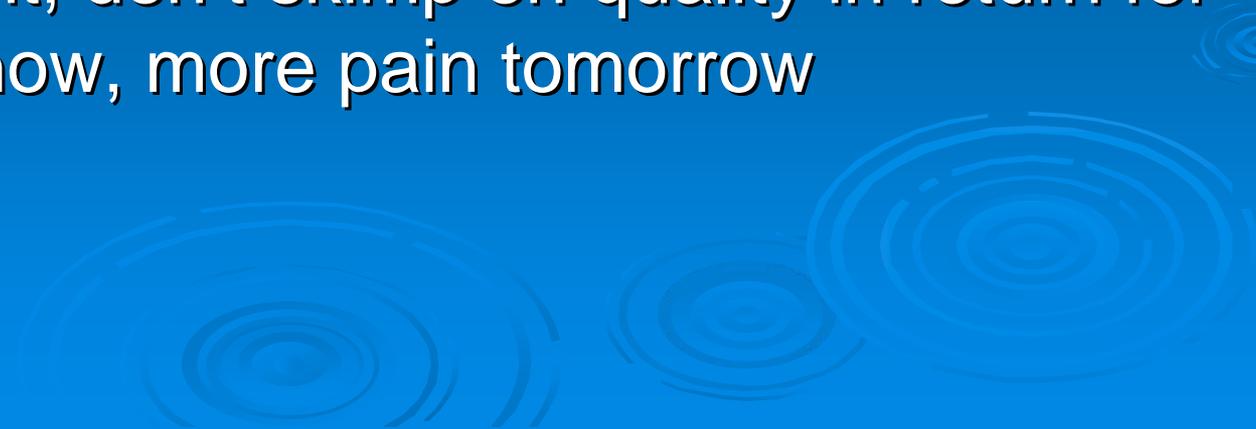
FIGURE 1A. VOLTAGE DEPENDENCE OF ALPHA SENSITIVITY FOR BULK TECHNOLOGIES, MEASURED WITH A TH-232 FOIL.

Cannon, Reinhardt,  
Gordon & Makowskyj

When DVS reduces voltage, the SER increases within an order of magnitude

Need to assess this with newer technology and develop reliability-friendly DVS algorithms

# What to do?

- Know what you are buying. Ask the right questions about the storage controller
  - Understand how power management is done, and how it will affect you
  - Don't count on system-level SER masking only, think about hardening your data
  - Be intelligent, don't skimp on quality in return for a low cost now, more pain tomorrow
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