

CISL Science and Technology Update

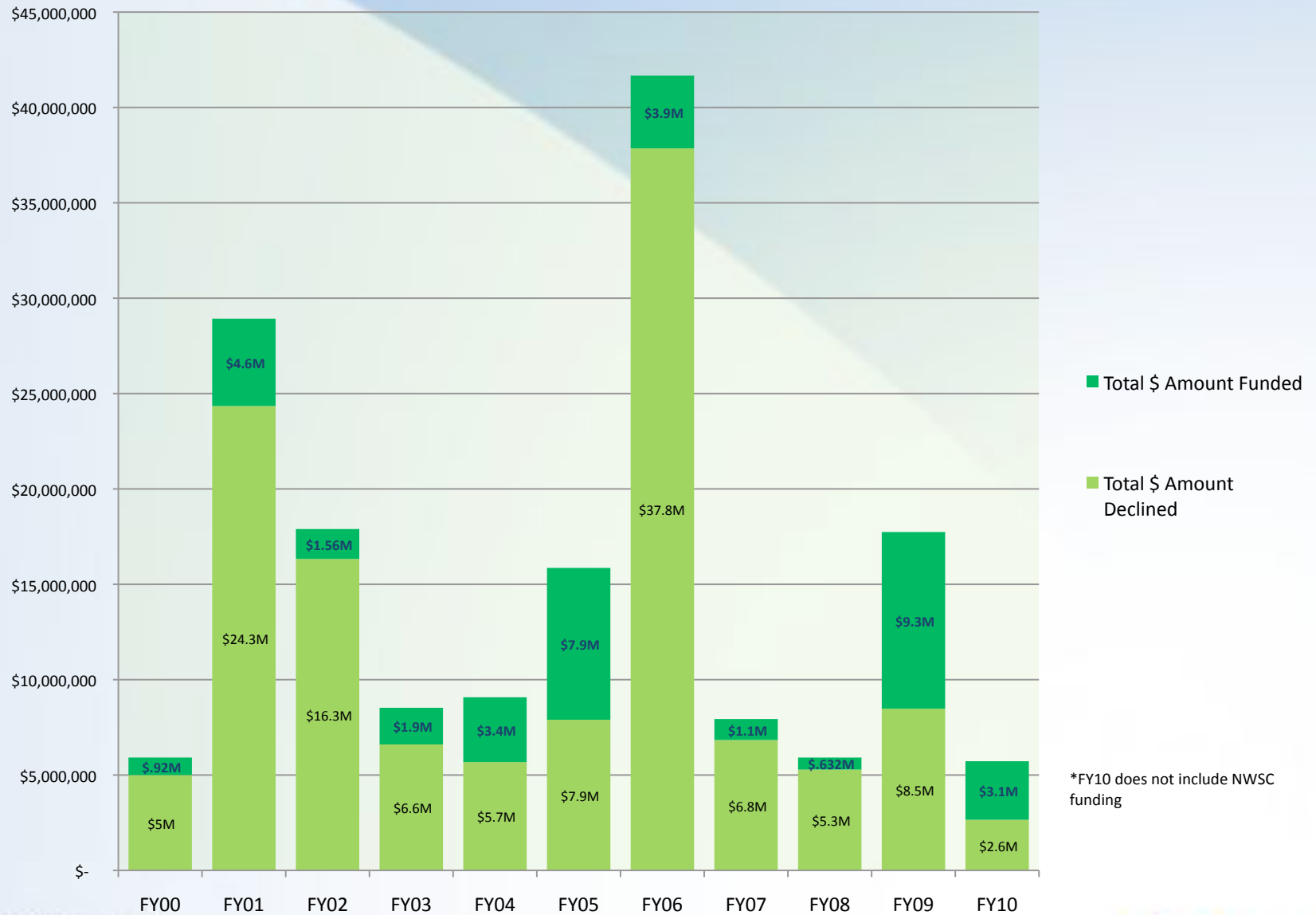
Richard Loft, TDD/CISL

CHAP Committee

October 21, 2010

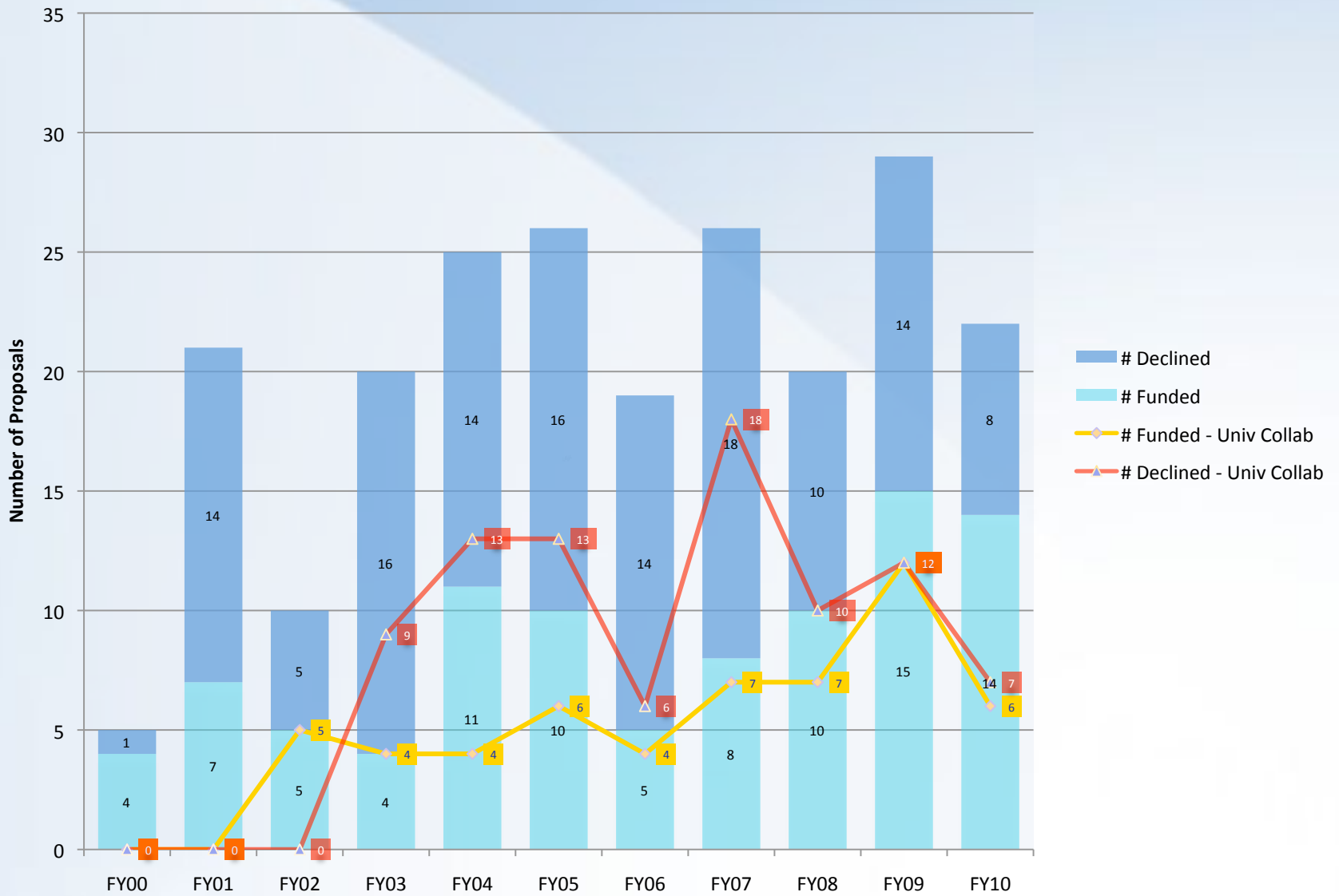
FY2010 Proposal Status

CISL Non-NSF Funding Success - \$ Funded & Declined



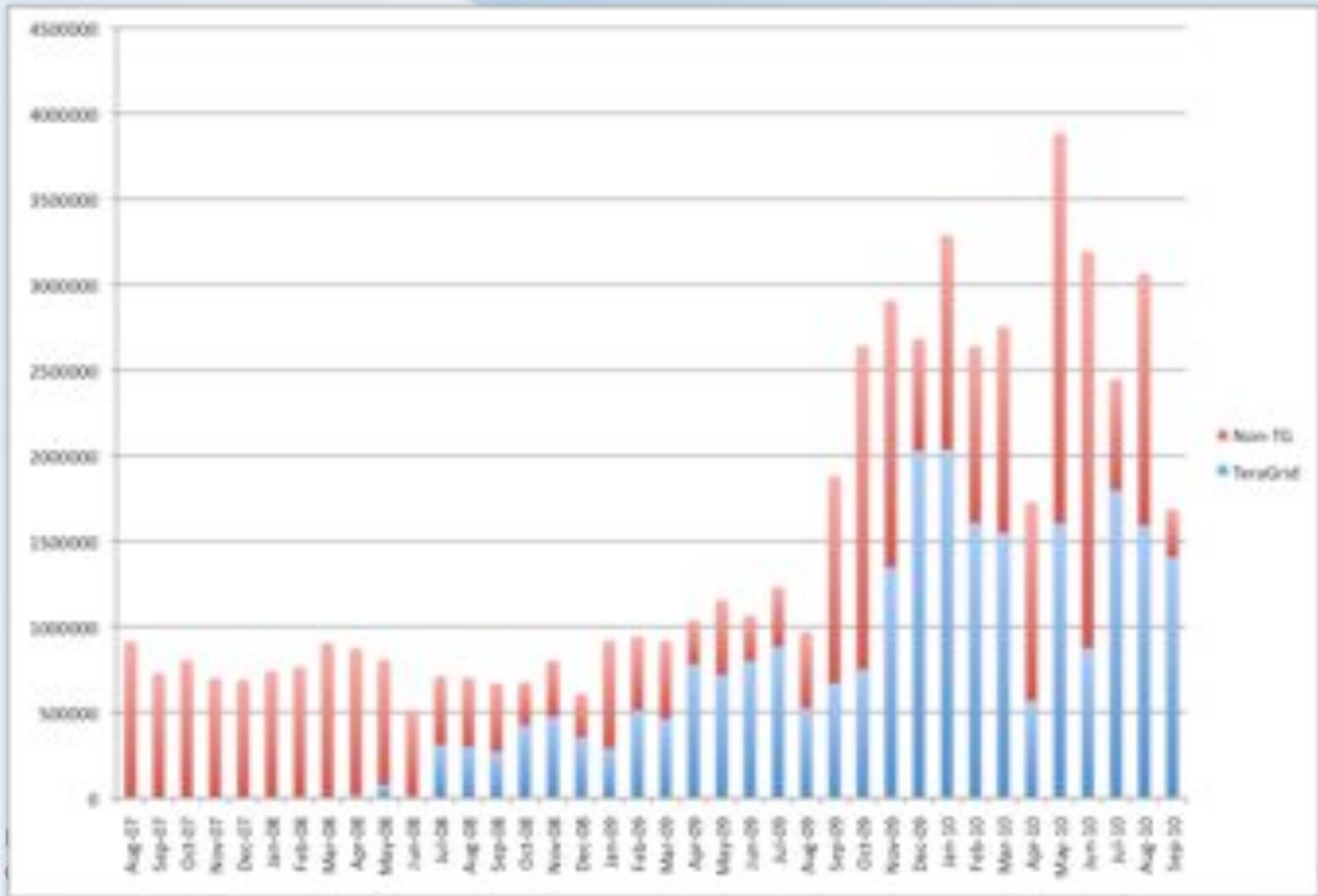
*FY10 does not include NWSC funding

CISL Non-NSF Funding Success - # Funded & Declined

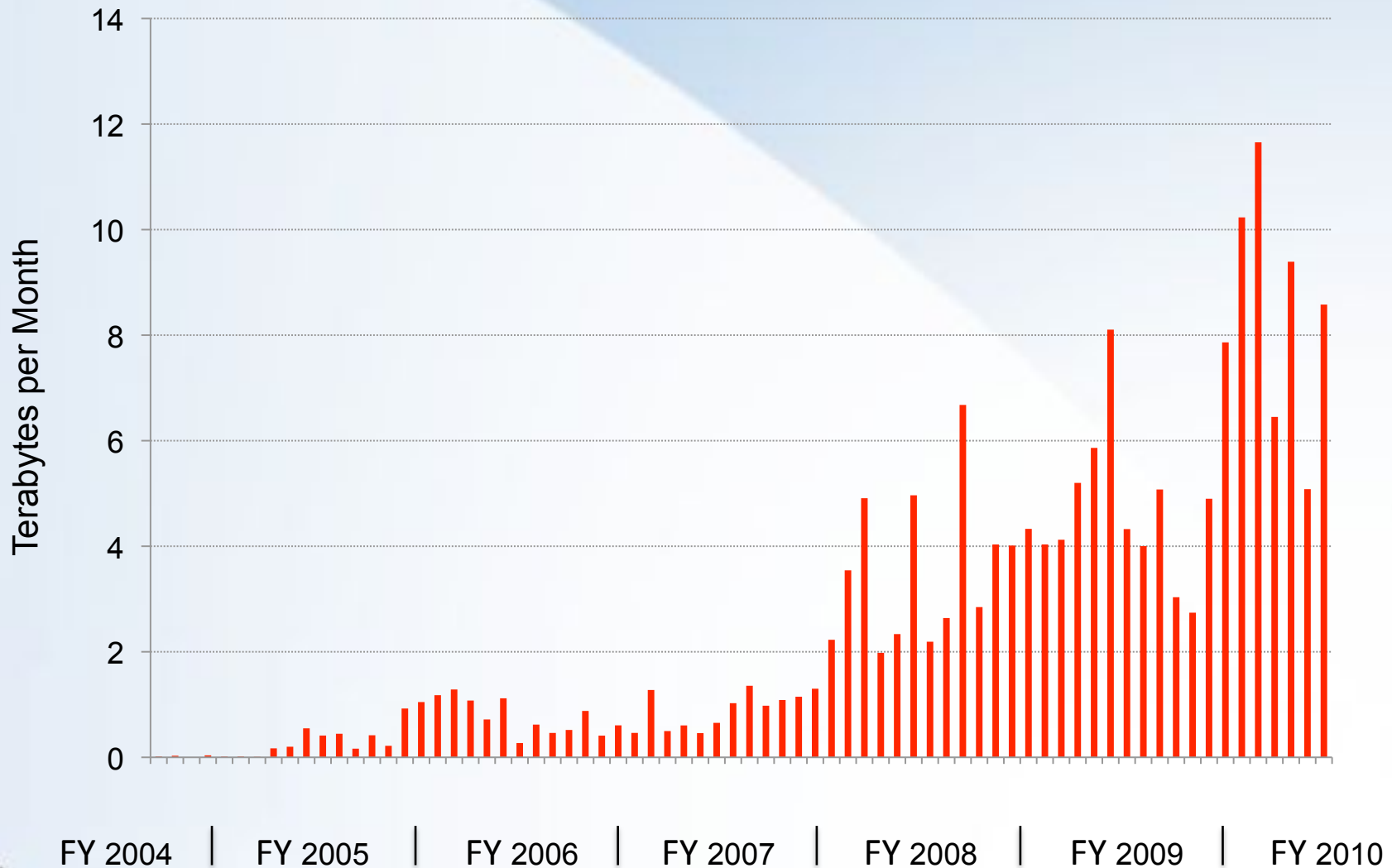


Cyberinfrastructure

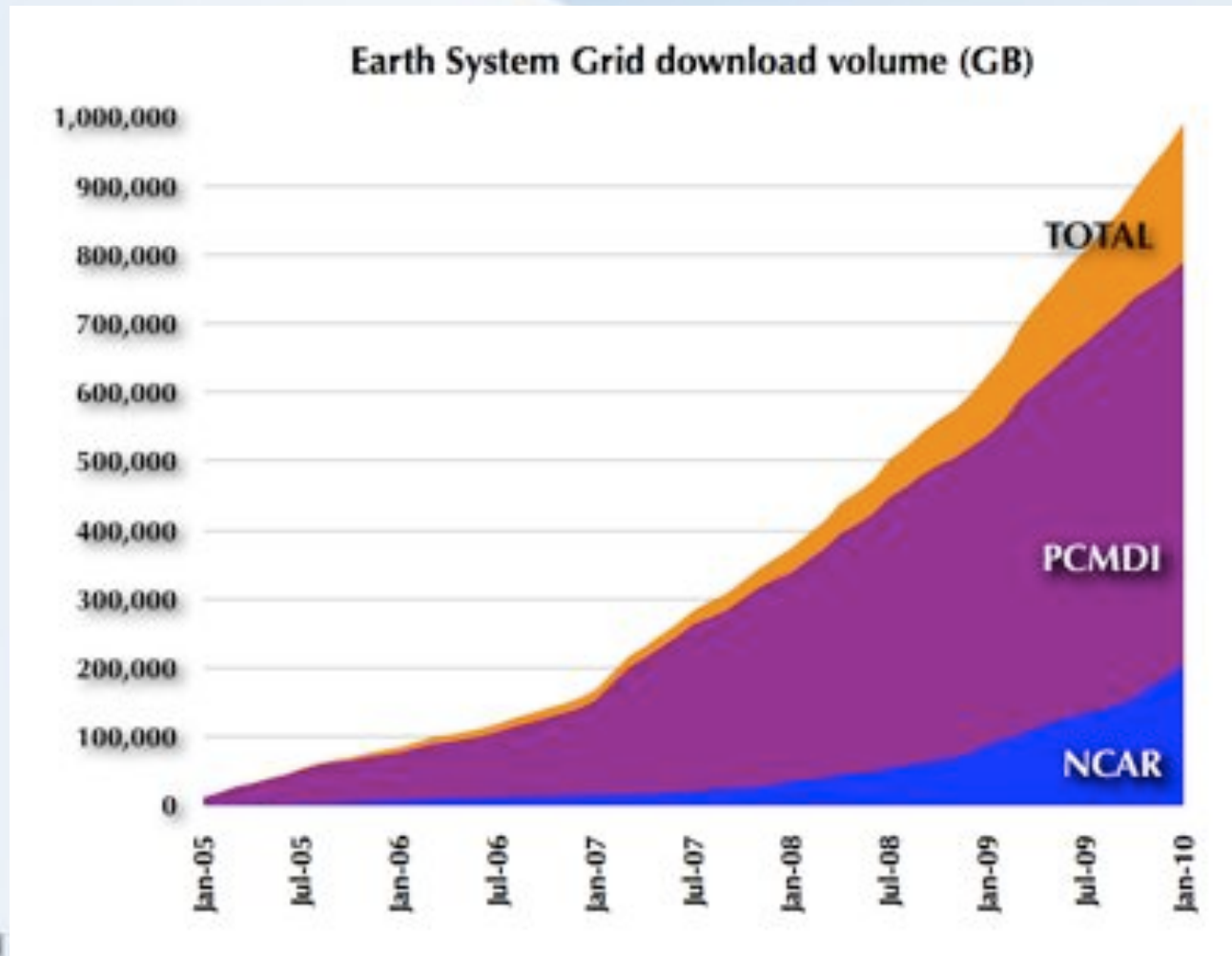
TeraGrid Update: Frost Utilization



NCAR Monthly Science Gateway Download Volume



February 2010: ESG has delivered a *Petabyte* of climate data to the global community



Education and Training Status

NCAR Summer Training Activities in Computational Science



Virtual School in CS &E (10 sites)

Scaling to Petascale

24 students at NCAR July 6-9 , 2010

Fortran 90

**22 students
July 19, 2010**

DA&V Boot Camp

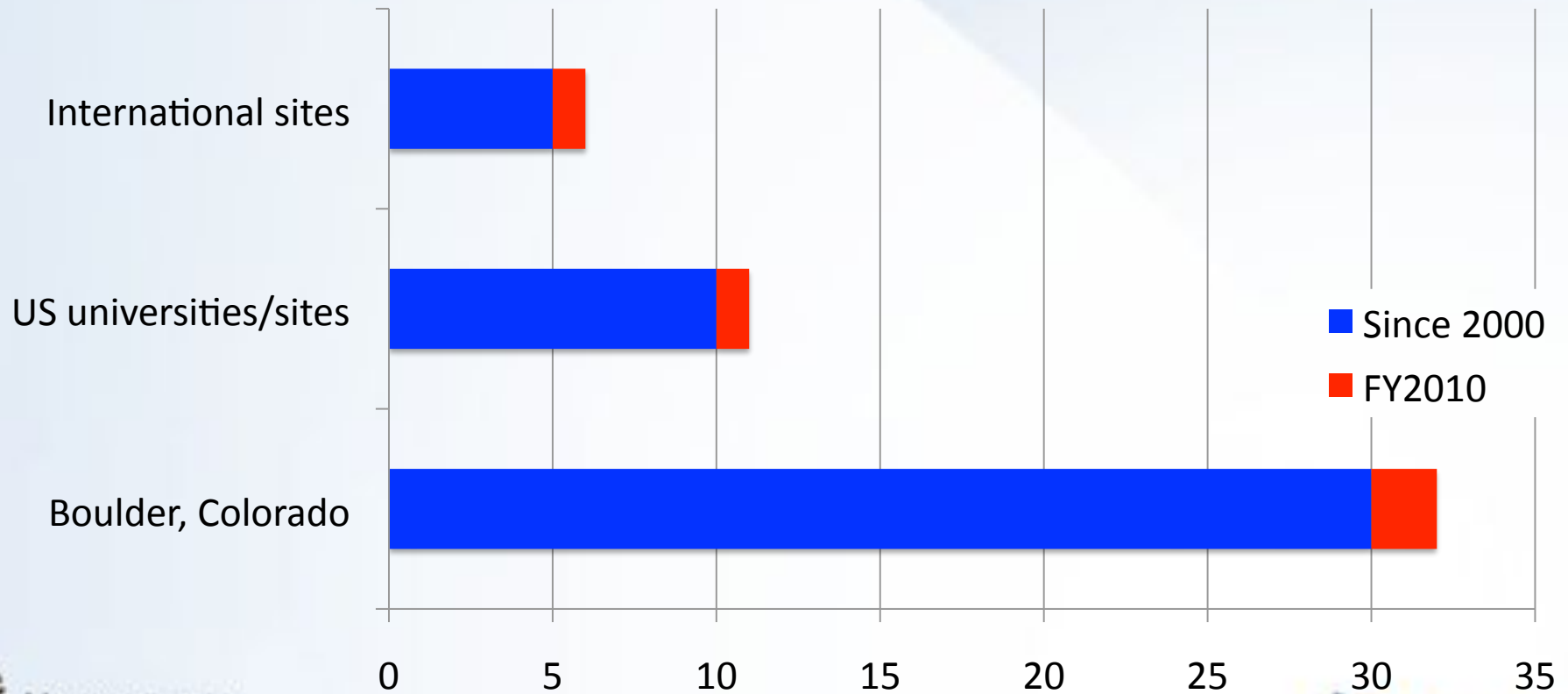
**16 students
July 20-23 , 2010**

NCL Workshops

Started in February 2000
4 more scheduled for 2010
624 attendees (expect 76 more for remaining classes)



Number of workshops



Summer Internships in Parallel Computational Science



SIParCS Classes

- **Summer internship program open to:**
 - Upper division undergrads
 - Graduate students
- **In Disciplines such as:**
 - CS, Software Engineering
 - Applied Math, Statistics
 - Earth System Science
- **Support:**
 - Travel, Housing, Per diem
 - 10 weeks salary
 - Conference and Publication costs
- **Number of interns selected:**
 - 7 in 2007, 11 in 2008,
 - 14 in 2009, **20 in 2010**
- **Application window for summer 2011:**
 - Dec 1 – February 4

<http://www.cisl.ucar.edu/siparcs>

Exascale and electrical power

Estimating the number of operations in a simulated year

- $\text{Flop/year} = Cf / (\Delta x^3)$
- Where, for a **100 level model**
 - $C = 5.5 \times 10^{17} \text{ km}^3/\text{year}$
 - $f = \text{flops/update}$
 - $\Delta x = \text{lattice spacing in km}$
- What is an estimate for f ?
 - *fv-CAM* **$\sim 1500 \text{ flops/update}$**

**Sustained petaflops rate required
for
1 simulated years per day =
9.55 / (Δx^3)**

Data Requirement (100 layers)

- **A single field of 8 byte reals:**
 - 408 GB/ (Δx^2)
- **Multiplicative factors**
 - Number of variables saved
 - Output frequency (per year)
- **Assume**
 - 1 snapshot file per day for a year (365 files)
 - 150 fields
 - 61 TB history files
 - 22.3 PB data set – per day!

Power and Memory Bandwidth

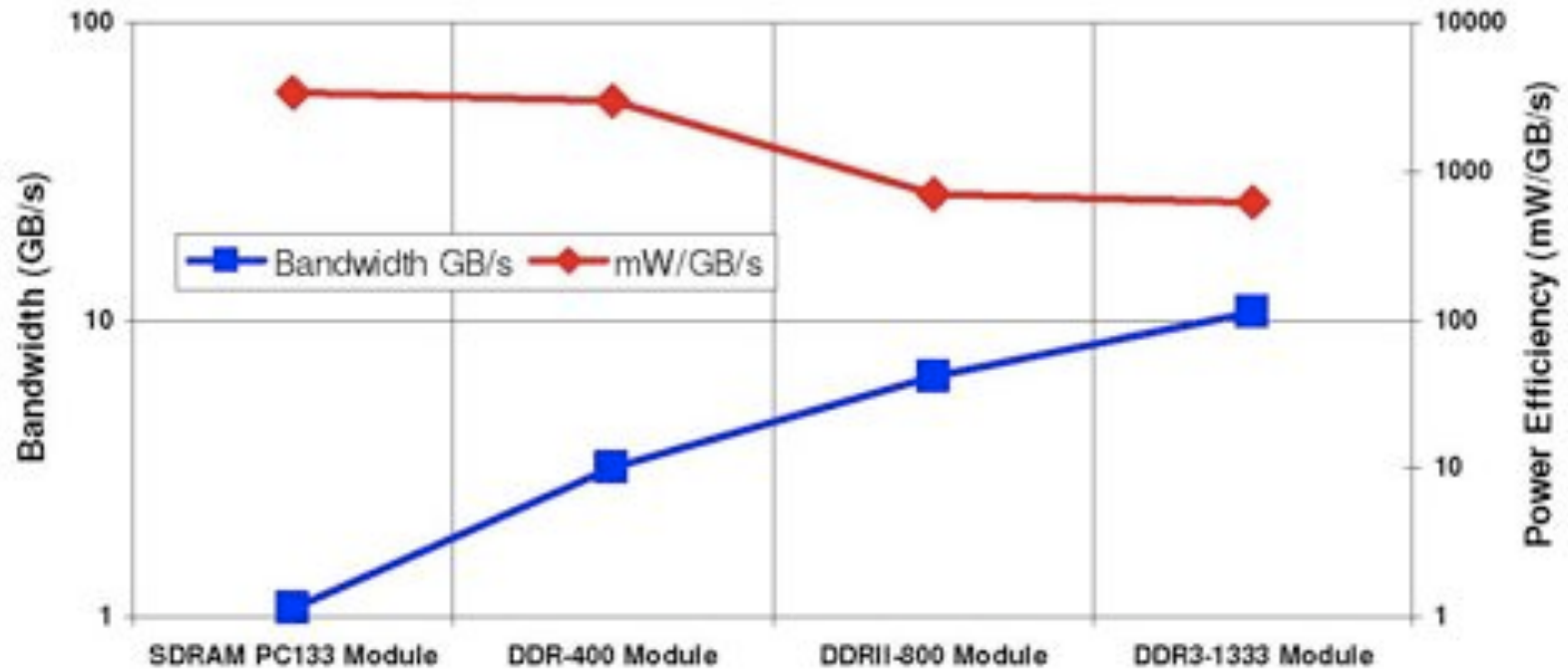


Figure 6.22: Commodity DRAM module power efficiency as a function of bandwidth.

O(1) watt/GB/s is relatively constant over time

Memory Bandwidth means Power

- Assume one, 8-byte word loaded from memory per flop
- To sustain $O(10)$ PFLOPS, we will need 80 PB/sec
- Using the DDR figure of merit, we the memory we need is **~80 MWatts**.
- This suggests a memory technology is required to achieve this capability.

