PITAC
HIGH-END COMPUTING

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Presentation Structure

- Committee Members
- Findings
- Funding Recommendations
- Comments

PITAC High-End Sub-panel Innovative Technologies & Architecture

David Patterson

Thomas Sterling Mary Vernon

PITAC High-End Sub-panel Software

Jack Dongarra

Dan Reed, George Spix

Irwing Wladawsky-Berger

PITAC High-End Sub-panel Sustain Petaops/Petaflops

Thomas Sterling

Steve Wallach

PITAC High-End Sub-panel Acquisition of High-End Systems

Steve Wallach Larry Smarr

Dave Cooper Bo Ewald

FINDINGS

6 Findings

1. High-End Computing is essential to science and engineering research
2. High-End Computing is an enabling element of the US national security program
3. New applications of high-end computing are ripe for exploration
4. US suppliers of high-end systems suffer from difficult market pressure

FINDINGS

- ❺ Innovations are required in high-end systems
  - application-development software
  - algorithms
  - component technologies
  - computer architecture
- ❻ High-End computing Available to civilian science & engineering is dangerously behind the state of the art

Finding -1

- High-End computing essential for science and engineering research
  - understand natural phenomena
  - explore and optimize engineering designs
  - current "extreme" performed by mission agencies like DoE (ASCI) and DoD
  - Academic sponsored by NSF

Finding -2

- High-End computing is essential for the US national security program
  - DoD HPC Modernization Programs
  - DoE ASCI
  - NSA

Finding -3

- New Applications of High-End are ripe for exploration
  - develop new uses of high-end to promote a better understanding of our world
  - improve services to all citizens
  - New uses
    - intelligent systems - data mining
    - design
    - crisis management
    - infrastructure support

Finding -4

- US Suppliers of high-end suffer from difficult market pressures
  - consolidation within industry
  - movement away from vectors
  - foreign competitors have government subsidies

Finding -5

- Continued Innovations are required for high-end systems
  - breakthroughs needed that are aimed at sustained performance
  - current federal programs are too small
  - trickle down and technology transfer to mid-range

Finding - 6

- High-End computing available to civilian science and engineering behind the state of the art
  - factor of 10 to 20 behind largest installed systems
  - reduction of NSF centers from 4 to 2 without increasing the funding for remaining has reduced the overall capacity available to academic researchers.

RECOMMENDATIONS

1. Fund Research into innovative computing technologies and architectures
2. Fund R&D on software to improve the performance of high-end computing
3. Attain a sustained petaops/petaflops on real applications by 2010
4. Fund the acquisition of the most powerful high-end systems to support science and engineering research
5. Expand the CIC and HECC working group's coordination to handle all major elements of the governments investment in high-end computing

Recommendation -1

- Fund Innovative Computing Technologies and Architecture
  - new technologies; optical, quantum, biological, and neuromorphic
  - new simulation and analysis tools
  - industry participation needed.

Recommendation -2

- Fund R&D on software to improve performance.
  - System software
  - Algorithm development
  - Manage integrated systems in a balanced fashion

Recommendation - 3

- Fund research to build a system to attain a sustained petaop/petaflop system on real applications by 2010
  - substantial technological advances needed
  - goal is a technology driver
  - balanced effort of both hardware and software

Recommendation -4

- Fund the acquisition of the most powerful high-end systems to support science and engineering research
  - recent Nobel Prize in Chemistry
  - track the DoE ASCI program
  - support of Research Expeditions to the 21st. Century

Recommendation - 5

- Expand Government's coordination process to include all major elements of the investment in high-end computing
  - budgets and plans provided to NSTC, CIC HECC working group.
  - Need a cross-cut process to better invest and evaluate investments

Funding Recommendation

Table 1 Funding increases for High-End Computing Research ($ millions)

	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
High-End Software, Architectures, and Petaops Computing	180	205	240	270	300
High-End Acquisitions	90	100	110	120	130
Total	270	305	350	390	430

COMMENTS

- PACI Center Recommendations
- PetaOp/PetaFlop Expedition
- Coordination of the government's investment in High-End Computing