MDA and the Design of Design

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PEO STRI at a Glance

Vision **. . . Putting the Power of Simulation into the Hands of Our Warfighters**

Mission **. . . Provide life cycle management of interoperable training, testing and simulation solutions for soldier readiness and the defense community.**

- **Army's Training, Testing, Modeling and Simulation Materiel Developer**
- **Army Executive Agent for Combat Training Centers' Instrumentation**
- **Training Aids, Devices, Simulators and Simulations**
- **Instrumentation, Targets and Threat Simulators for Training & Testing**
- **Support to Battle Labs, other Materiel Developers (PEOs & PMs), and Combatant CDRs**
- **Life Cycle Support from Development through Disposal**

FY04 Budget

Direct Mission $	805 M
Customer	$ 306 M
Total	$1.4 B

Contracts Managed

- **Total Number 341**
- **Total Dollar Value $6.7B**

Locations

- **Orlando, FL**
- **Redstone Arsenal, AL**
- **Ft. Bliss, TX**

FY03 Personnel Authorizations

Military	31
Civilian	496
Navy Matrix	126
Total	653

5 Board-Selected Colonel Project Managers

Acquisition Programs

- **100+ Active Programs**
- **1 ACAT ID Program**
- **2 ACAT II Programs**

PM FCS - $18M

Life Cycle Support

- **Fielded Systems with Inventory Value of Over $2.7B**
- **Over 5,500 Training Systems at 189 CONUS Sites and 13 Foreign Countries**

Motto: All But War is Simulation

Current and Future Challenges

- Complex Missions (Joint Urban Operations, Joint Close Air Support)
- Complex Organizations (Joint Task Forces, Coalitions)
- New Methods of War (Information Attack/Denial, Robotics, Sensor to Shooter)
- Asymmetric Threats
- Proliferation of Commercial Off-the-Shelf Tech
- Complex Weapons Systems and Ammunition
- OPTEMPO
- Lack of Spectrum and Space
- Rapid Technological and Social Change

Death Marches in DoD Software Development

- Politics - Internal or personal factors result in impossible constraints being established ("the project must be completed by 1 May"). These constraints are either never questioned or issues are swept under the carpet with the smokescreen of "it's just politics".
- Naive promises - Senior management makes promises to customers or marketing without checking with the development team.
- Naive optimism - Developers with little experience or maturity, underestimate the effort involved. When committed they lack the confidence to retract their estimates.
- The "Marine Corps" mentality - Developers understand the impossibility of the task ahead, which becomes some kind of weird challenge. This do-or-die mentality is fueled by a lethal mix of inexperienced team members, weak project management, and a general gung-ho attitude.

Source: Stewart Baird, *Sams Teach Yourself Extreme Programming in 24 Hours*, 2003

We learn from **experience**. A man never wakes up his second baby just to see it smile.

Grace Williams

Thoughts Borrowed from Fred Brooks

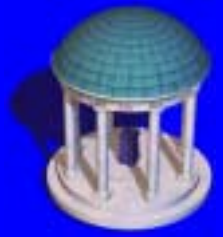
21st Century Design Issues

I. Models of the design process

II. Collaborative teams and solo/chief designers

III. How to get *great* designs

Is MDA is Code Generation or Design Process?

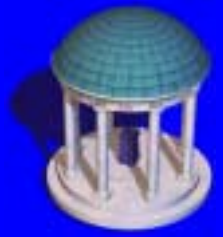


Design Models

Pathological Anecdotes Abound

- **The rational model is wrong—doesn't describe what really goes on**
- **Most expert designers don't work that way**
- **It can give bizarre results**
  - **LHX helicopter functional specs**

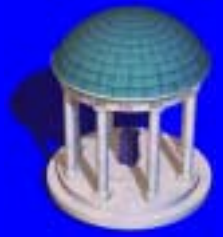
Became the Commanche Death March!



Evolutionary Software Development

1. Build a minimal working system.
2. Try it with real users.
3. Revise.
4. Add function in small increments.

- Robust under changing desiderata and constraints.
- Early testing exposes our inevitable mistakes.



Great Designs Come From Great Designers

- **How does one do great designs *within* a product process?**
- **How to make a product process than encourages, rather than inhibits, great designs?**
- **Where elitism is proper**
- **Entrust design to a chief designer**

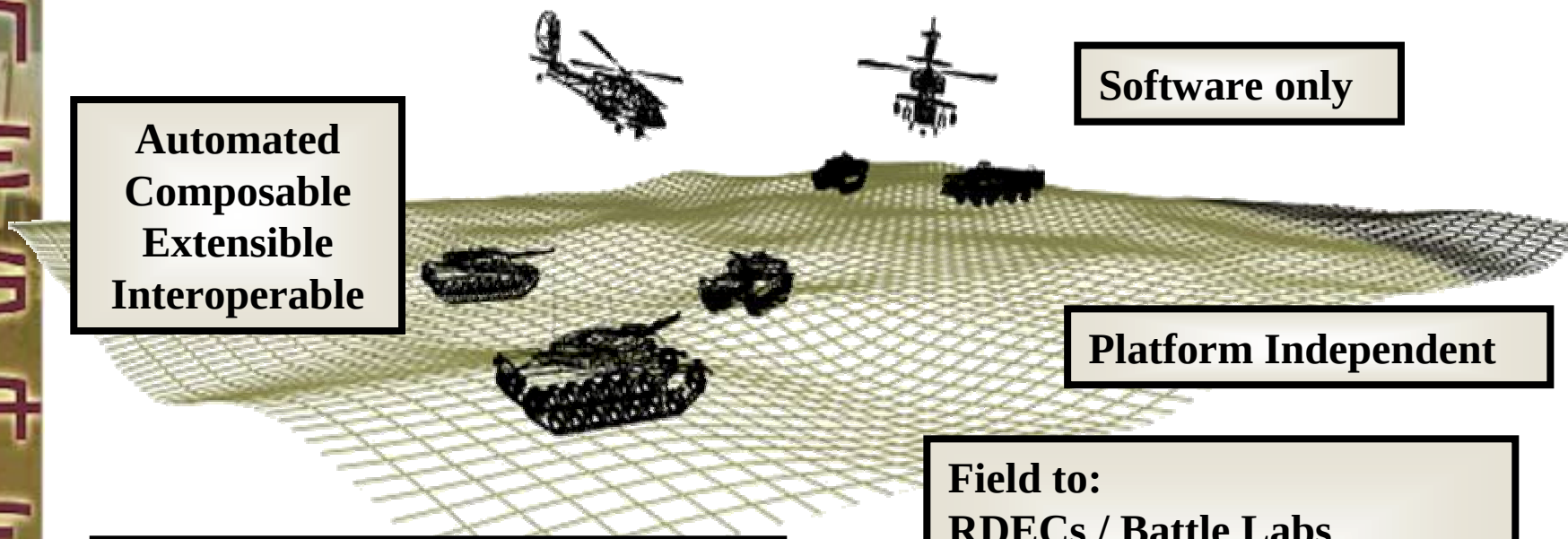
Key to Developing a Common Abstraction

Example of Successful Design at PEO STRI

ARMY PROGRAM RECOGNIZED AS ONE OF DEFENSE DEPARTMENT'S BEST (ORLANDO) May 3, 2004 - The Army's **Program Executive Office for Simulation, Training and Instrumentation (PEO STRI)**, headquartered in Orlando, Florida, cited strong teaming arrangements and sound software development approach as key contributors to the One Semi-automated Forces (OneSAF) Objective Systems success in the recent ***CrossTalk*** awards presentation.On April 23, 2004, Lt. Col. John R. (Buck) Surdu, Army Product Manager for OneSAF; Ms. Beverly Kitaoka, senior vice president and general manager of SAIC's Technology and Simulation Solutions Business Unit; and Tom Radgowski, SAIC program manager, accepted the award at the annual awards ceremony in Salt Lake City, Utah, where sponsors recognized the Defense Department top five software programs. The award was presented by the Director of Acquisition Resources and Analysis Office of the Undersecretary of Defense (Acquisition, Technology and Logistics) and ***CrossTalk***, the Journal of Defense Software Engineering. This is the second year the program has been recognized at the annual conference. OneSAF OOS predecessor, OneSAF Test Bed, was recognized in 2003.

What is One Semi-Automated Forces (OneSAF) Objective System (OOS)?

A composable, next generation CGF that can represent a full range of operations, systems, and control process (TTP) from entity up to brigade level, with variable level of fidelity that supports multiple Army M&S domains (ACR, RDA, TEMO) applications.



Automated
Composable
Extensible
Interoperable

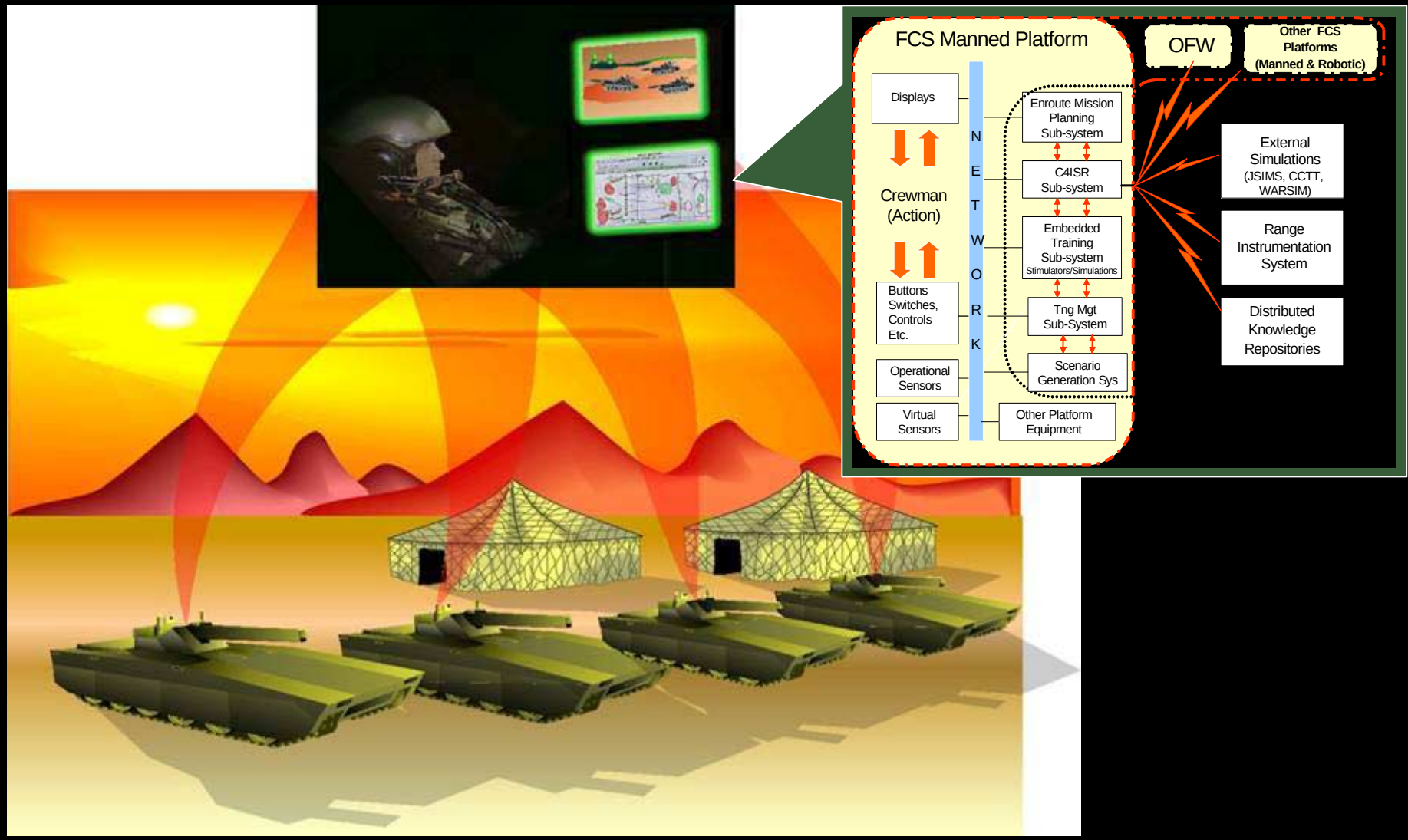
Software only

Platform Independent

Replaces legacy entity based Simulations: BBS – OTB/ModSAF - JANUS - CCTT/AVCATT SAF

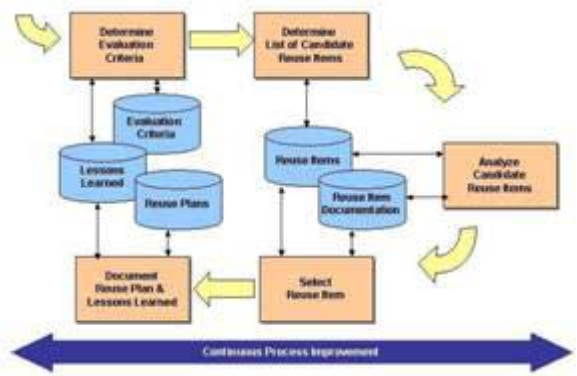
Field to:
RDECs / Battle Labs
National Guard Armories
Reserve Training Centers
All Active Duty Brigades and Battalions

Embedded Simulation with OneSAF



Program Execution Approach Key Points

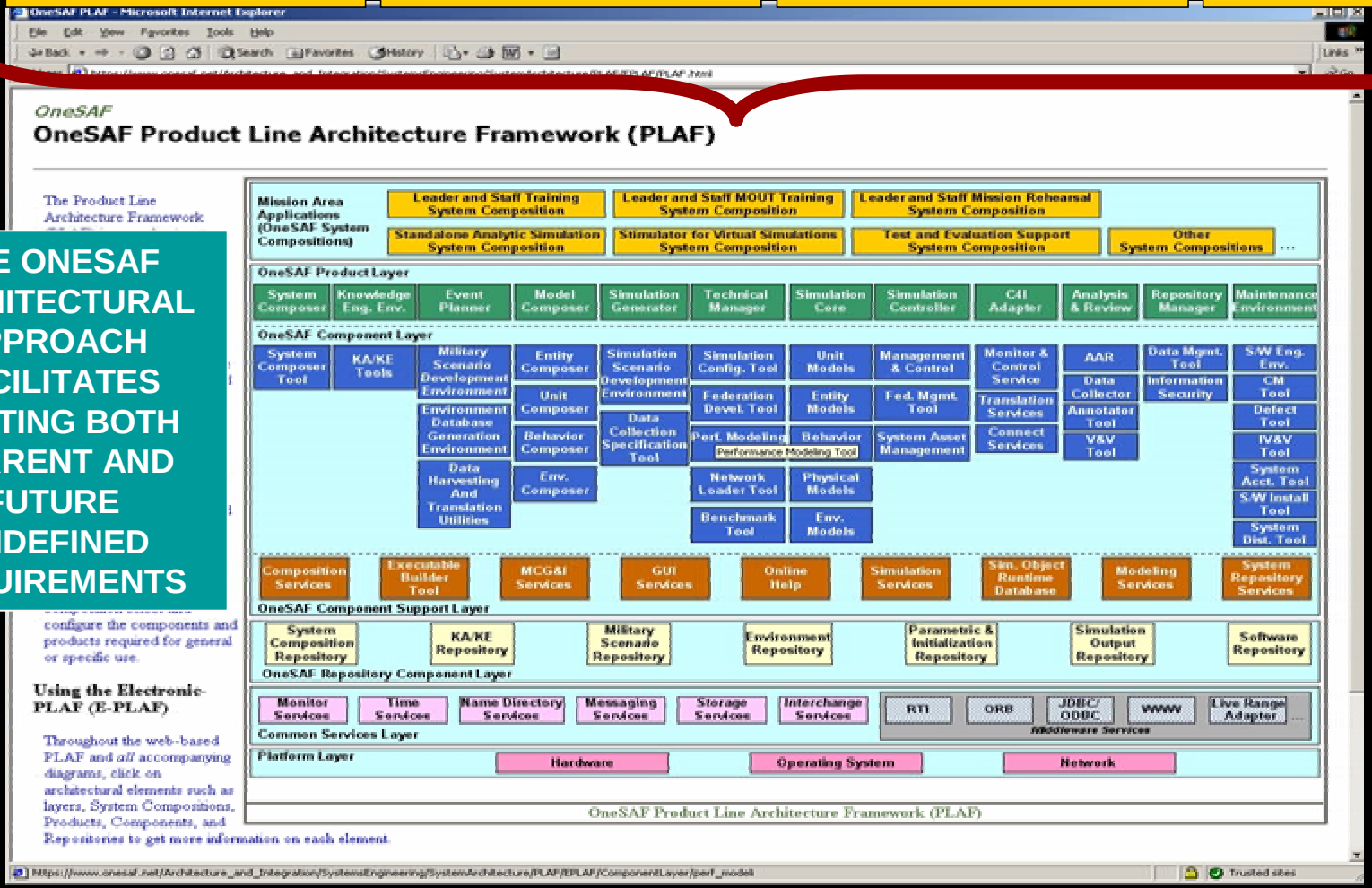
- No "Big Bang"
  - Iterative System and Architecture Development, concurrent with Software Development and Integration
    - Do not wait for "perfect" paper specification or complete system analysis before beginning software
  - Iterative Software Development and System Integration
    - Get something running, continuously integrate
    - Provide a usable system early and encourage user feedback
  - Incremental development and progress through phased program Blocks
    - Blocks A – D (2001 – 2005)
    - Incremental builds within a Block
      - Block A: Builds 1 – 8 (7/2001 – 10/2002)
  - Continuous User evaluation
    - Integration lab
    - User evaluation baselines
    - IPT
    - On-site TPO and Domain representatives
    - SMARTeams
- Emphasis on Directed and Recommended Reuse
  - Tracked and enforced through IPT process



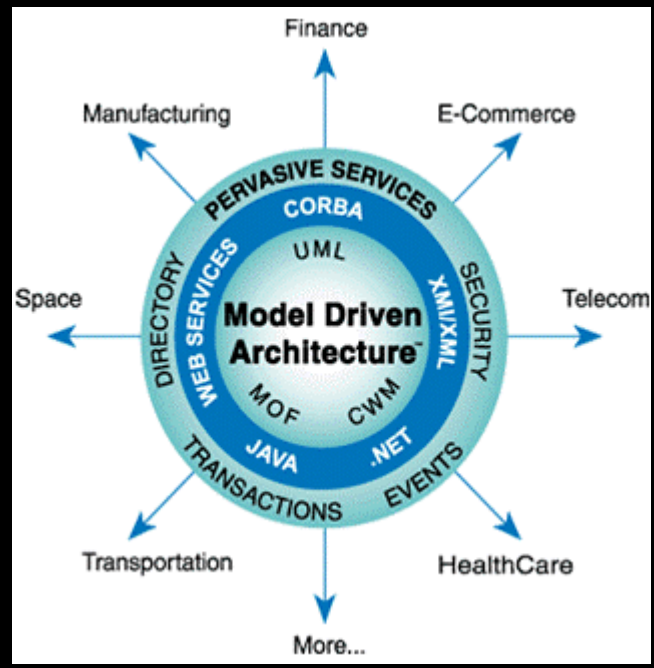
OneSAF Product Line Architecture

Leader and Staff Training System Composition	Leader and Staff MOUT Training System Composition	Leader and Staff Mission Rehearsal System Composition	
Standalone Analytic Simulation System Composition	Stimulator for Virtual Simulations System Composition	Test and Evaluation Support System Composition	Other System Compositions

THE ONESAF ARCHITECTURAL APPROACH FACILITATES MEETING BOTH CURRENT AND FUTURE UNDEFINED REQUIREMENTS



OneSAF has a Model Driven Architecture



- Platform independent model
- UML
- Java
- XML
- Code Generation and Round Trip Engineering (TogetherJ Enterprise)
- Component architecture
- Composability

Problems on the Bleeding Edge

How can we apply MDA to novel applications and R&D?

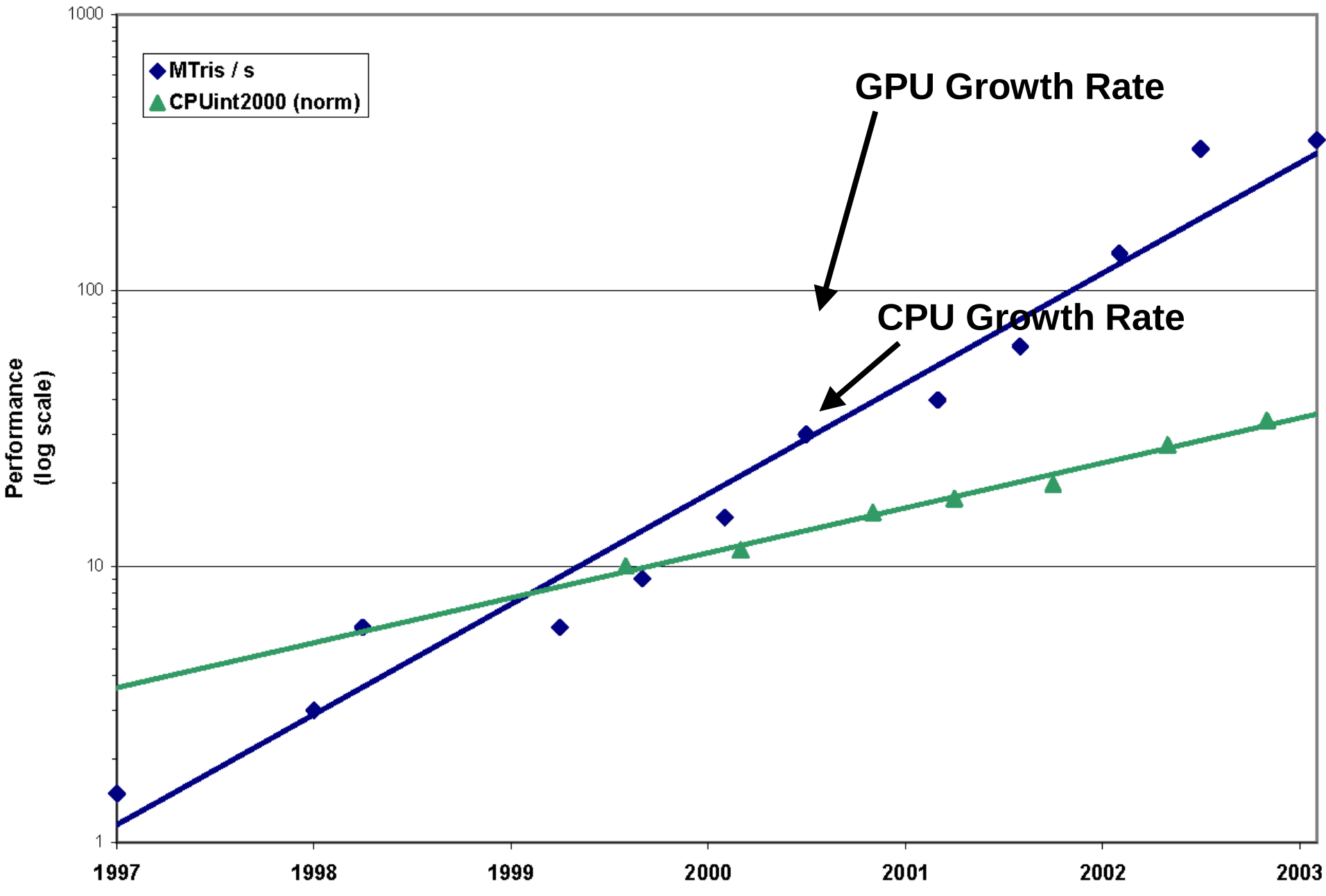
Real-time Computational Challenges for Computer Generated Forces

Need to provide interactive, real-time terrain reasoning for Computer Generated Forces given:

- Extremely dense terrain databases (e.g. Baku, NYC, Baghdad)
- Thousand of simulated entities (size of Army Unit of Action)
- Simulation of long-range and novel sensors
- Must fit on Future Combat System platforms (no Beowulf clusters allowed)

Bottomline: Traditional CPU architecture and Moore's law are not enough to achieve capability in this decade.

Exploiting New Hardware Architectures



Full Spectrum Warrior: Game Consoles for Squad Leaders

Best Original Game and Best Simulation at E3.

"A dark horse, a sleeper hit, a hidden gem. But we will settle for saying that this military simulation game was the best original title at E3."

"Apart from Full Spectrum Warrior's amazing visual and aural presentation, the two standout elements in the game are its context sensitive AI (which in this case could stand for "Actually Intelligent") and its revolutionary user interface."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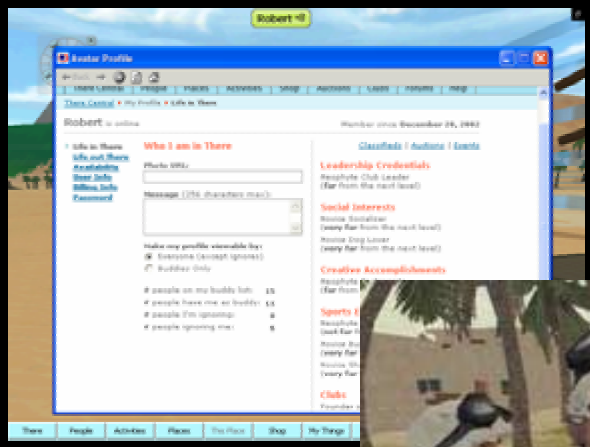
FULL SPECTRUM
WARRIOR

Massive Multiplayer Environments

- Collaborative environment with over 100,000 participants
- Project at STTC
- Social organization
- Global classroom



Key Lessons

- MDA won't eliminate Death Marches
- MDA works in the hands of intelligent designers and the appropriate class of problem and with reasonable requirements
- You need a Chief Designer who can abstract the problem and tell you what it is and how you are building it in 30 seconds or less (e.g. OneSAF's Anthony Courtemanche)
- Evolutionary code development is mandatory
- Fred Brooks was right: no silver bullet