2000 NPSS Review & Planning Meeting

NASA Glenn Research Center
October 4-5, 2000

Overview Presentation

John Lytle

2000 NPSS Review

Outline

- **Background**

- **1999 Industry Feedback**

- **FY00 Status**

  - **Resource distribution**

  - **Major accomplishments**

- **FY01 Major Milestones**

- **Future Direction**

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High Performance Computing and Communications (HPCCP)

- The main goal of the HPCCP is to accelerate the development of high-performance computers and networks and the use of these resources in the Federal Government and throughout the American economy.

- The GRC primary role in the HPCCP is through the Computational Aerospace Sciences (CAS) Project. The goal of CAS is to accelerate the availability of high-performance computing hardware and software to the United States aerospace industry for use in their design processes through the solution of *Grand Challenge* problems.

- The goal of the NREN Project is to research, develop and deploy advanced network technologies required by high-performance mission applications that satisfy the needs of the researcher while guiding commercial infrastructure development for the nation.

- The goal of the LTP is to enhance the learning of math, science and engineering in the K-12 educational system through the use of computing and communications technologies and dissemination of information about the NASA missions.
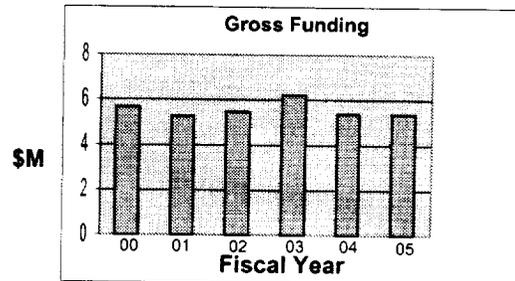
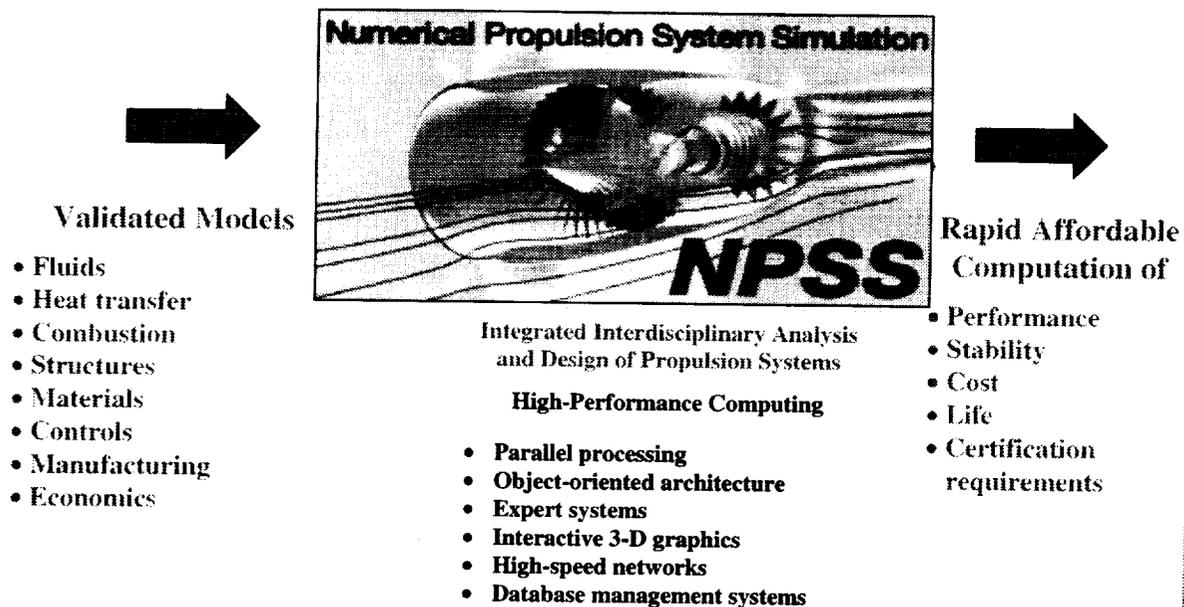*CAS*

Computational Aerospace Sciences

NREN
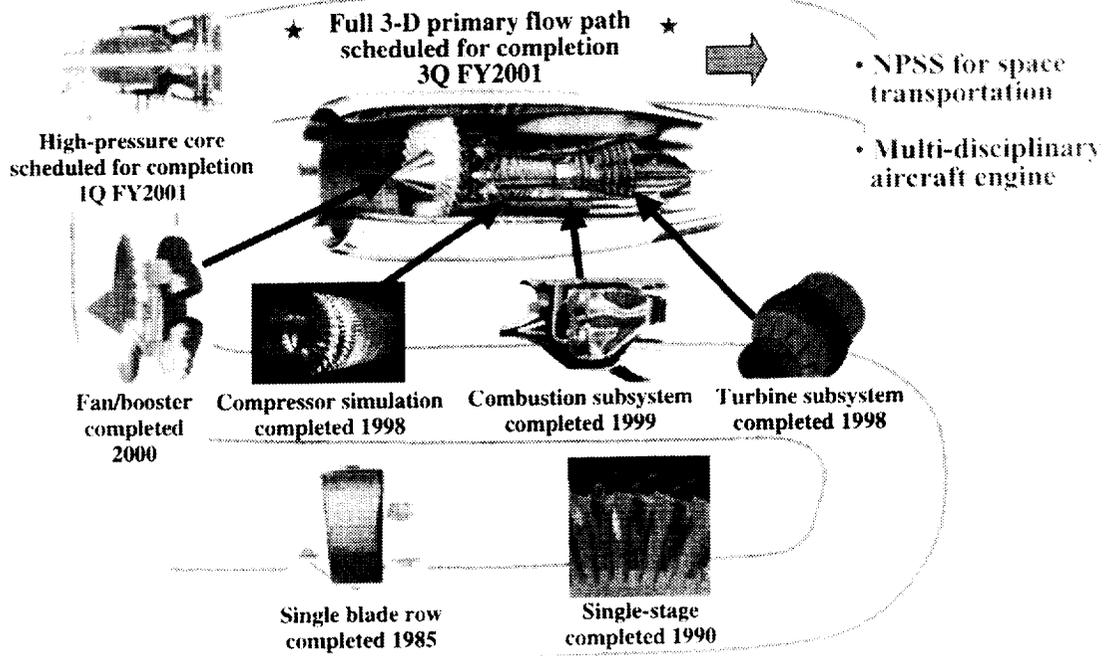*NASA Research and Education Network*

LTP
Learning Technologies Project

Gross Funding

$M

Fiscal Year: 00, 01, 02, 03, 04, 05

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Numerical Propulsion System Simulation

NPSS

Integrated Interdisciplinary Analysis
and Design of Propulsion Systems

High-Performance Computing

- Parallel processing
- Object-oriented architecture
- Expert systems
- Interactive 3-D graphics
- High-speed networks
- Database management systems

Validated Models

- Fluids
- Heat transfer
- Combustion
- Structures
- Materials
- Controls
- Manufacturing
- Economics

Rapid Affordable Computation of

- Performance
- Stability
- Cost
- Life
- Certification requirements

A Numerical Test Cell for Aerospace Propulsion Systems

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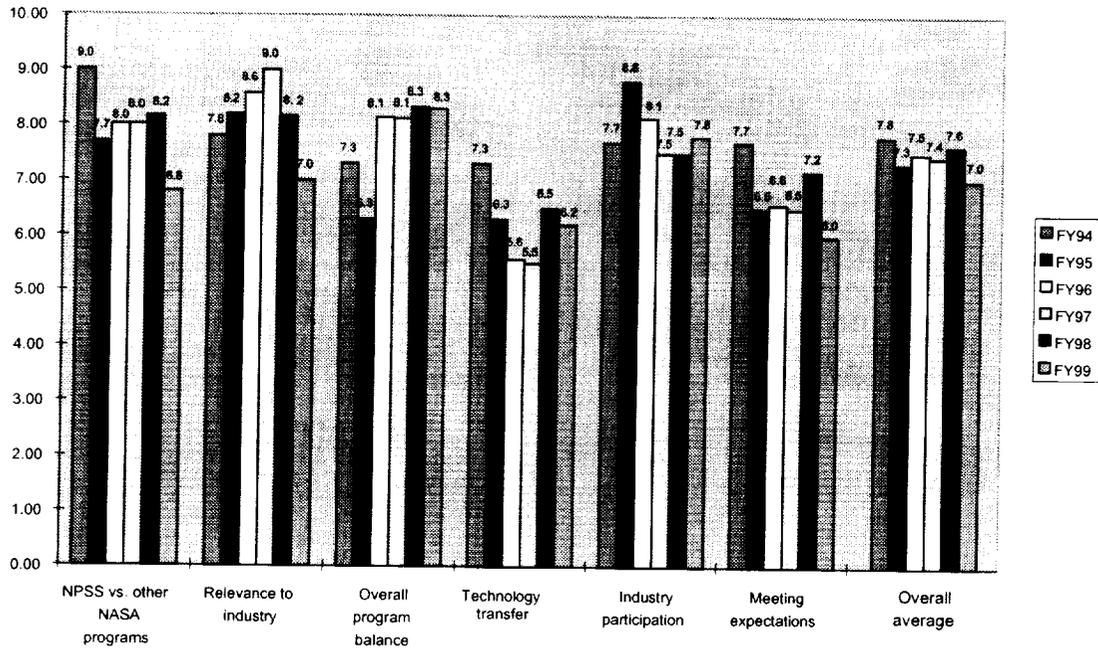
The Road to Full 3-D Overnight Engine Simulation

Full 3-D primary flow path
scheduled for completion
3Q FY2001

High-pressure core
scheduled for completion
1Q FY2001

- NPSS for space transportation

- Multi-disciplinary aircraft engine

Fan/booster completed 2000	Compressor simulation completed 1998	Combustion subsystem completed 1999	Turbine subsystem completed 1998

Single blade row
completed 1985

Single-stage
completed 1990

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HPCCP/NPSS
Work Breakdown Structure

Engineering
Applications

- Code Parallelization
- 3–D Subsystems/System

Computing Testbeds

Component integration

Simulation
Environment

MD coupling

Zooming

- Gov't/industry collaborative effort
- Object-oriented programming
- CAD geometry interface

Seamless integration of people, data, analysis tools, and computing resources

- Coupled aero-thermal-structural analysis
- Hierarchical methods

- 0-D engine/1-D compressor
- 0-D core/3-D LP subsystem

- High-speed networks
- PC cluster
- Distributed computing

Low-cost, distributed parallel computing

High-fidelity, large-scale simulations

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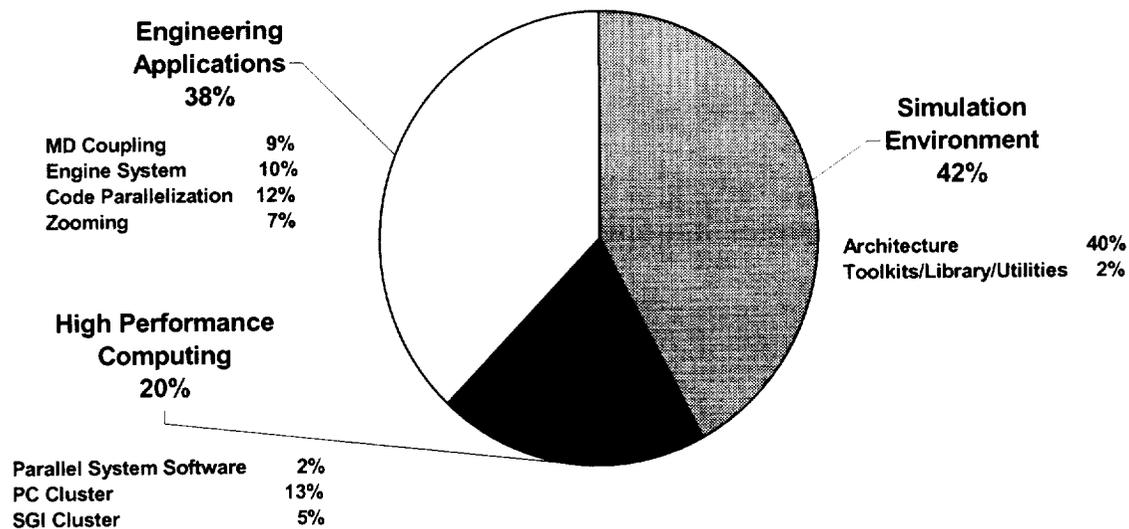**Overall NPSS Program Ratings**

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FY99 Executive Committee Report

- Phase I, II, & III definitions are out of date or muddled. Restructure and replan to build on the architectural framework, to reflect new focus on integrated CAD analysis capability and high-fidelity/MDO, all tied together with the architecture.

- Concern that Phase 1, including VBS, will not be developed to maturity to enable adoption by industry.

- Unclear on how to integrate access to space objectives. Need to clarify with clear roadmaps and objectives.

- Clearer definition of transition from NPSS to ISE is required.

- International export of industry standard and basic architecture must be separate from items that will have export control issues.

- Must develop specific plan to provide long-term support and maintenance.
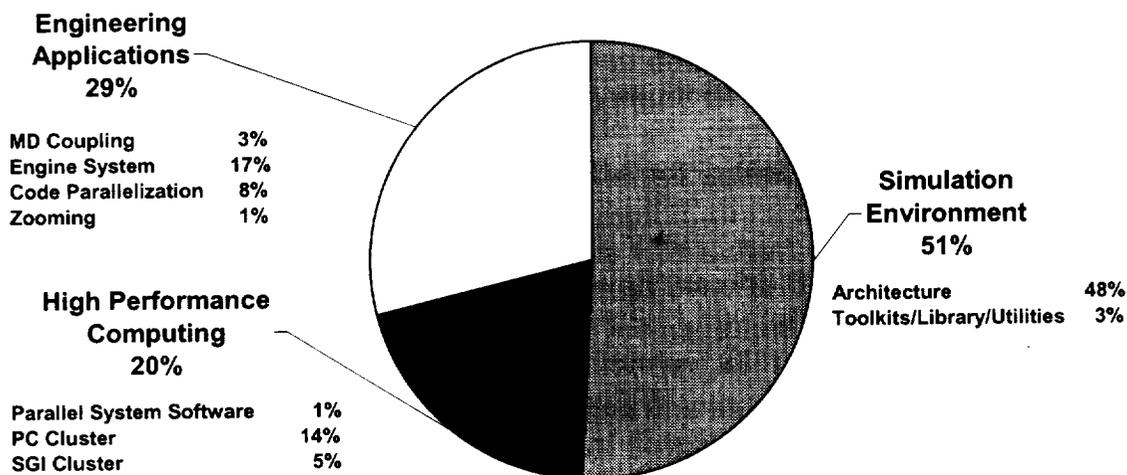
- Encourage IHPTET and VAATE usage.

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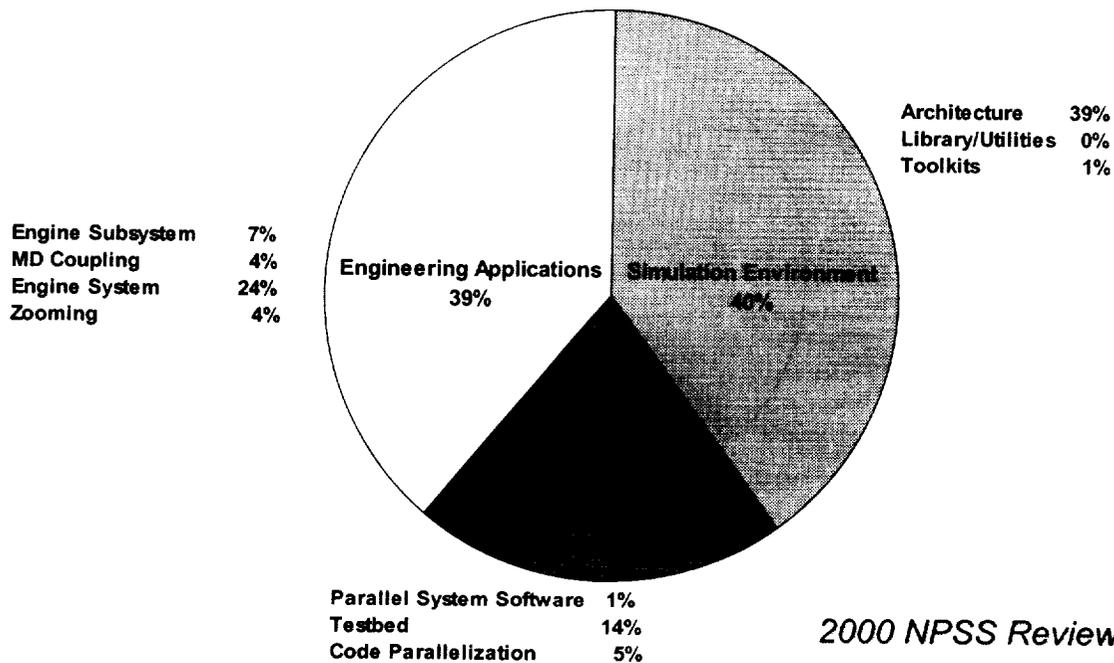# Distribution of Resources
FY00 Net R&D Funds

Engineering Applications 38%

MD Coupling	9%
Engine System	10%
Code Parallelization	12%
Zooming	7%

Simulation Environment 42%

Architecture	40%
Toolkits/Library/Utilities	2%

High Performance Computing 20%

Parallel System Software	2%
PC Cluster	13%
SGI Cluster	5%

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Distribution of Resources
FY00 Net R&D Funds and CS FTE

Engineering Applications 29%

MD Coupling	3%
Engine System	17%
Code Parallelization	8%
Zooming	1%

Simulation Environment 51%

Architecture	48%
Toolkits/Library/Utilities	3%

High Performance Computing 20%

Parallel System Software	1%
PC Cluster	14%
SGI Cluster	5%

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Distribution of Resources
FY99
Net R&D Funds and CS FTE

Architecture 39%
Library/Utilities 0%
Toolkits 1%

Engine Subsystem 7%
MD Coupling 4%
Engine System 24%
Zooming 4%

Engineering Applications 39%

Simulation Environment 40%

Parallel System Software 1%
Testbed 14%
Code Parallelization 5%

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Selected FY00 Highlights

- Delivered NPSS V 1.0 in March (transient, dynamic linkable libraries, fully interpreted elements, data reduction, distributed objects). V2 requirements completed.

- Demonstrated a 547:1 reduction in combustion simulation time and a 400:1+ reduction in turbomachinery simulation time relative to a 1992 baseline.

- Initial coupling methodology for 3-D high-pressure core engine simulation completed.

- Completed the GE 90 fan/booster subsystem and combustor in preparation for the 3-D primary flowpath engine simulation.

- Demonstrated a 9.5:1 improvement in the performance/cost ratio for PC clusters relative to 1999 technology.

- NASA/industry team formed and implemented to define requirements and FY01 task for NPSS for space transportation.

- NPSS V1 proposed for use in GP 7000 and JSF engine development programs.

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FY01 Major Milestones

- Release NPSS V2 (real time ORB, CORBA security, limited zooming, dynamic load balancing, initial visual assembly language) (4Q).

- Demonstrate full 3-D compressor analysis in 3 hours and full 3-D combustor analysis in 2.5 hours (>1000:1 reduction relative to a 1992 baseline)(4Q).

- Demonstrate 100:1 reduction in unsteady turbomachinery analysis time relative to 1999 baseline with MSTURBO on the HPCCP parallel testbed (4Q).

- Complete 3-D primary flowpath simulation of an advanced aircraft engine (4Q).

- Complete 3-D aero/structural/probabilistic analyses. Initiate implementation into the NPSS architecture (4Q).

- Initial release of NPSS for space transportation propulsion (4Q)

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Future Direction

- **Continue to play a strong role in the High Performance Computing and Communications Program.**

- **Increased emphasis on space transportation and aero-space synergy in the near term.**

- **Alignment of long-range goals with Intelligent Synthesis Environment, Intelligent Systems, and Design for Safety.**

- **Initiate new collaborations with DOD and DOE.**
  - **Versatile Affordable Advanced Turbine Engine (DOD)**
  - **Integrated High-Performance Turbine Engine Technology (DOD)**
  - **Accelerated Strategic Computing Initiative (DOE)**
  - **Advanced Turbine Systems and Vision 21 (DOE)**
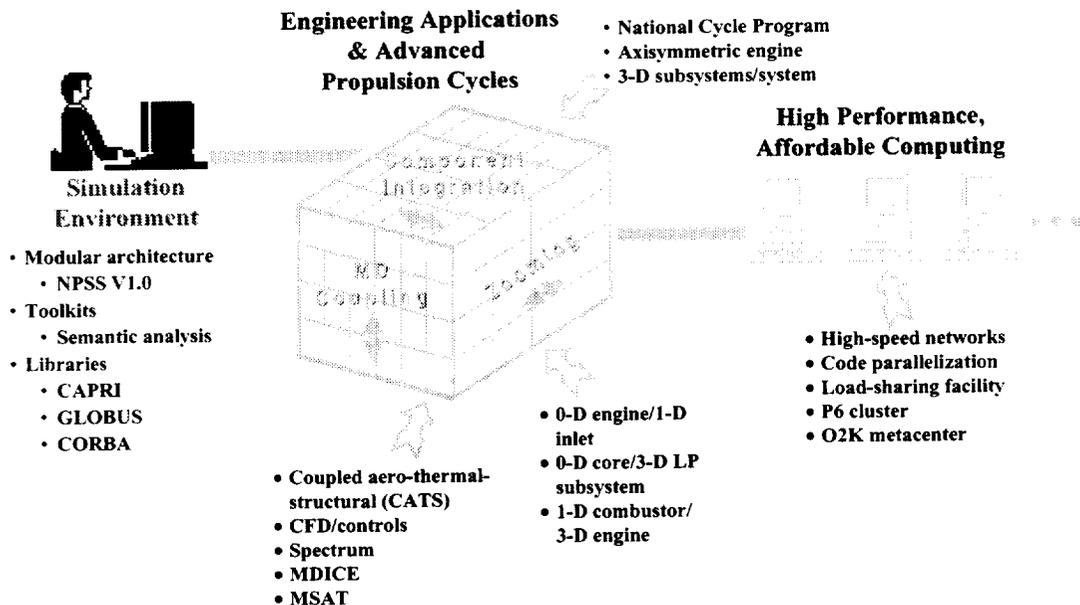
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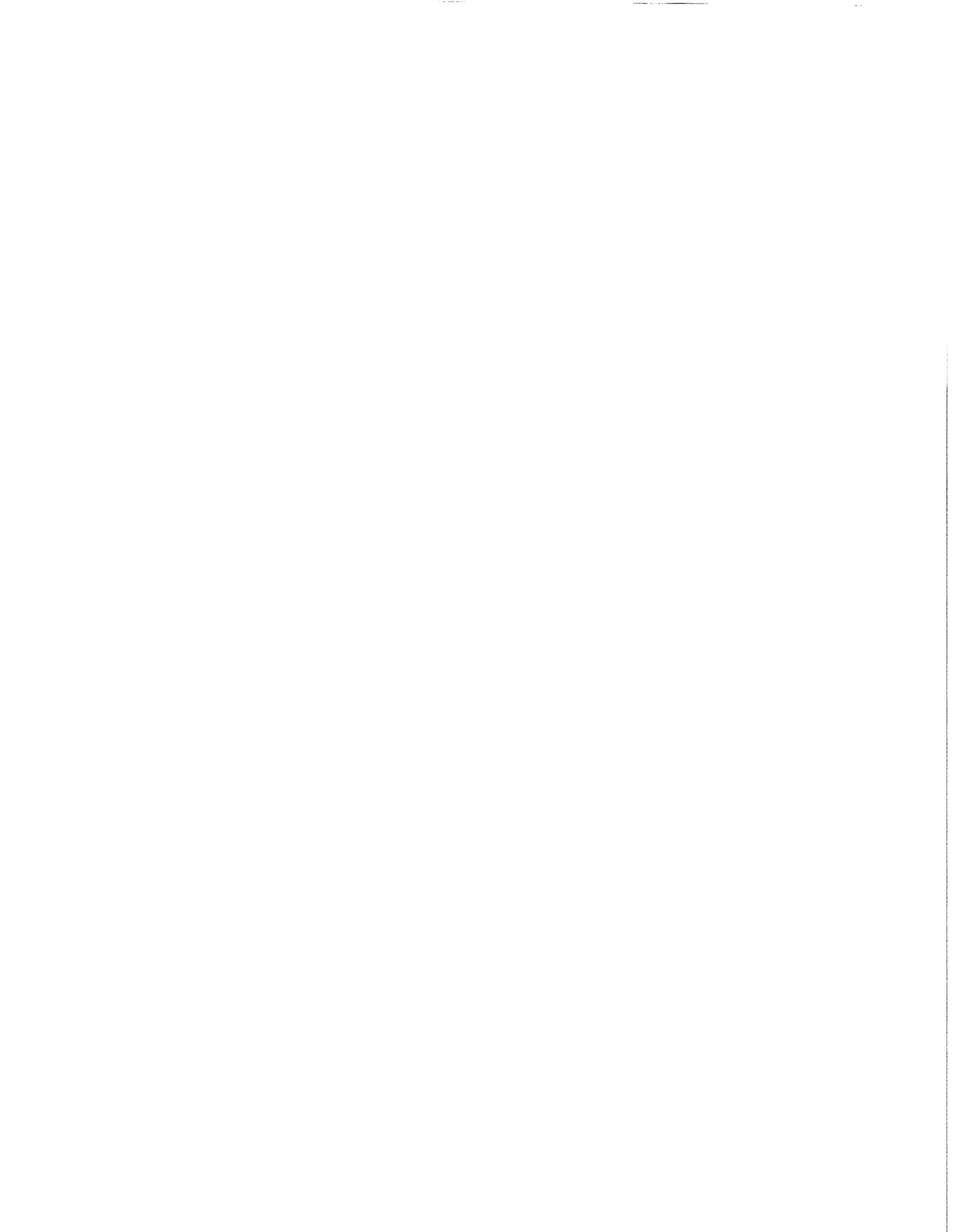
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Simulation Environment/ Production Software
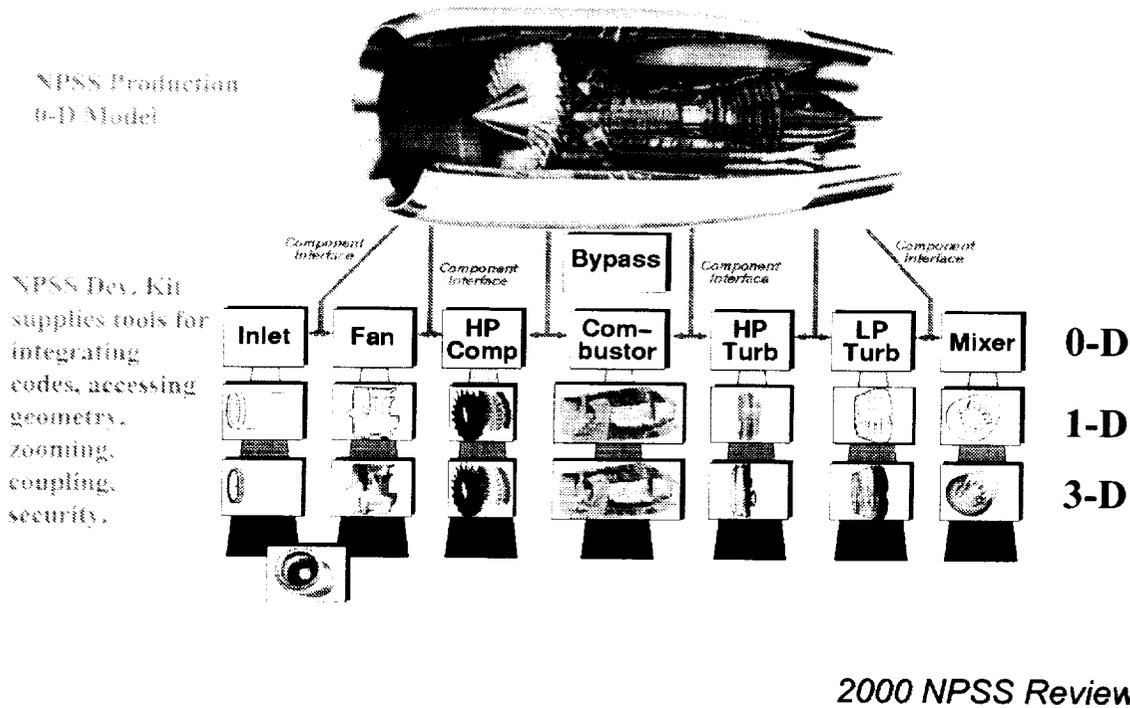
Gregory Follen
Cynthia Naiman

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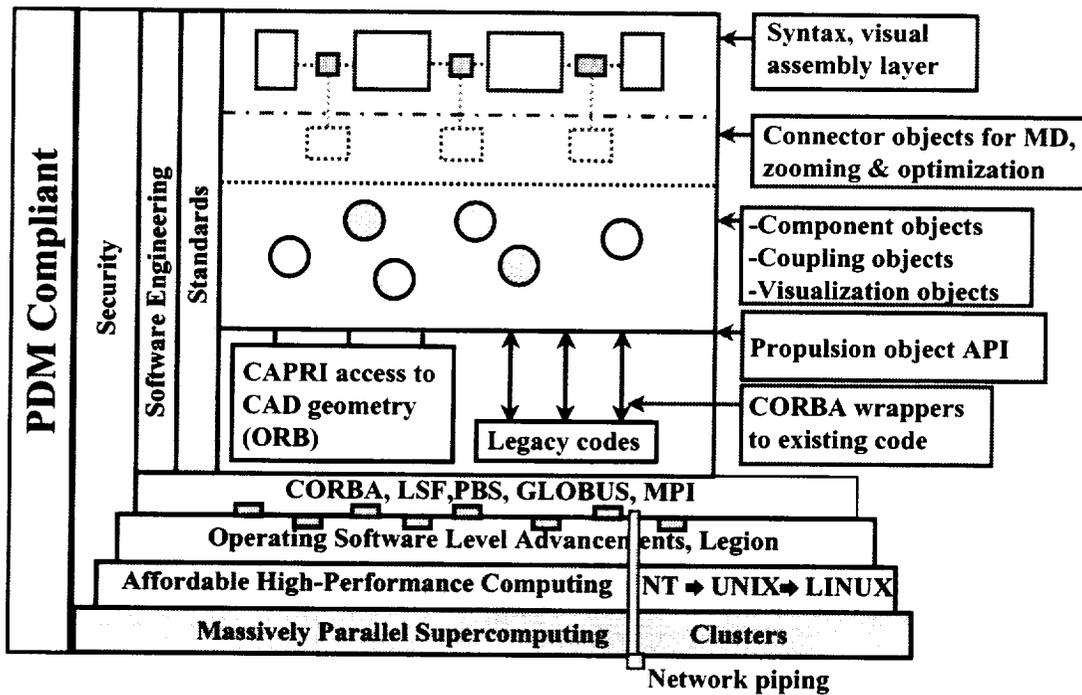

Simulation Environment/ Production Software

Engineering Applications & Advanced Propulsion Cycles
- National Cycle Program
- Axisymmetric engine
- 3-D subsystems/system

High Performance, Affordable Computing

Simulation Environment

- Modular architecture
  - NPSS V1.0
- Toolkits
  - Semantic analysis
- Libraries
  - CAPRI
  - GLOBUS
  - CORBA

- Coupled aero-thermal-structural (CATS)
- CFD/controls
- Spectrum
- MDICE
- MSAT

- 0-D engine/1-D inlet
- 0-D core/3-D LP subsystem
- 1-D combustor/ 3-D engine

- High-speed networks
- Code parallelization
- Load-sharing facility
- P6 cluster
- O2K metacenter

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NPSS Production and Simulation Architecture

NPSS Production
0-D Model

NPSS Dev. Kit
supplies tools for
integrating
codes, accessing
geometry,
zooming,
coupling,
security.

| Inlet | Fan | HP Comp | Com-bustor | Bypass | HP Turb | LP Turb | Mixer | 0-D |

1-D

3-D

NPSS Object-Oriented Architecture

PDM Compliant

Security

Software Engineering

Standards

Syntax, visual assembly layer

Connector objects for MD, zooming & optimization

-Component objects
-Coupling objects
-Visualization objects

Propulsion object API

CAPRI access to CAD geometry (ORB)

Legacy codes

CORBA wrappers to existing code

CORBA, LSF, PBS, GLOBUS, MPI

Operating Software Level Advancements, Legion

Affordable High-Performance Computing | NT ➔ UNIX ➔ LINUX

Massively Parallel Supercomputing | Clusters

Network piping

NPSS Production Topics

- Overview

- Milestones and Deliverables

- FY00 Accomplishments

- NPSS Version 1 Capabilities

- NPSS Version 2 Capabilities

- Current Status

- Schedule

NPSS Overview

- The Numerical Propulsion System Simulation (NPSS) is emerging as a U.S. industry standard simulation tool for propulsion and airframe companies.
- The modular, flexible, and extensible architecture developed for aeropropulsion simulations can be used for aerospace as well as other applications such as ground-based power systems.
- NPSS provides the functionality of a system simulation tool with increased flexibility for the user, which results in reduction of total development time and cost.
- NPSS has been developed using the object-oriented design with incremental releases.
    - The user's conceptual view of the physical components of the engine model can be mapped directly onto the object class hierarchy.
    - Rapid module creation, duplication, and customization is enabled by the interpretive engineering environment of NPSS.
    - The plug 'n play architecture enables much larger simulations to be performed because of the ease of "plugging" in new or larger modules.
    - This architecture can be extended to support multi-fidelity and multi-discipline simulations in future NPSS versions.
- Teaming with the end user is key to the development of a common modeling tool.

$50M/Year Estimated Aeronautics Industry Savings
If NPSS is Adopted

- Estimate $17M/year for one company - total of $50M/year savings results if NPSS is adopted by aeronautics industry:
  - Common simulation tool to use with partners and customers
  - Early detailed system-level analysis
  - Reduced cost of support, development, time-to-market, and training
  - Increased productivity
    - Improved code portability
    - Cross discipline process integration
    - Easier data query and collation
    - Easier data manipulation/display
    - Modular model sharing (preliminary design, controls, performance)
    - Increased automation
    - Multiple site/platform distributed modeling
    - Documentation automation
  - Increased accuracy of results earlier in the design process
- Benefits only include aeronautics estimated savings.

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Teaming User with Developer is Critical to Success

NASA/Industry Cooperative Effort (NICE-1)

NASA Glenn Research Center at Lewis Field
Honeywell
Rolls-Royce Corporation (RRC)
The Boeing Company
Arnold Engineering Development Center (AEDC)
Wright Patterson Air Force Base (WPAFB)
General Electric Aircraft Engines (GEAE)
Pratt & Whitney (P&W)
Teledyne Ryan Aeronautical
Williams International (WI)

Others who are interested:
U.S. Navy, Lockheed, Aerojet, Rocketdyne, DOE, P&W (power generation), GE (ground-based power), Dryden, Marshall, Langley, Ames

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NPSS Production Milestones and Deliverables

	2000 V.1	2001	2002 V.2	2003	2004	2005 V.3	2006
CAPABILITIES	Steady-state, transient, low-fidelity dynamic, reduced order & data reduction, low-fidelity flowpath, geometry design		Full performance envelope 2-D/3-D Euler, mid-fidelity dynamic, mid-fidelity geometry generation			Full engine performance 3-D Navier-Stokes steady-state, transient, high-fidelity geometry generation	
INTEROPERABILITY	Zooming 0-D<->1-D single component, CORBA multi-ORBs, distributed objects		Zooming 0-D<->1-D/2-D, 0-D<->3-D, single components, CORBA security, probabilistic sensitivity analysis			Zooming 3-D<->0-D/1-D/ 2-D, multiple components, multiple disciplines	
PORTABILITY	Sun, SGI, HP	NT, Linux					
RELIABILITY	High-control formal software development process with verification and validation for each incorporation						
RESOURCE MGT	Globus, LSF		Dynamic load balancing, networked clusters				
USABILITY	Script assembly language, dynamic linkable libraries, fully interpreted elements, interactive debug		Visual assembly language				
PERFORMANCE			1000:1 reduction in execution time of 3-D turbo machinery & combustion simulation	Real-time ORB			

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FY00 Accomplishments

- 3/00: Distributed NPSS Version 1.0.0 on schedule, meeting an FY00 NASA Glenn Strategic Implementation Plan milestone.
  - Change requests (CRs) incorporated since the last full version release on August 25, 1998:
    39 requirements + 96 enhancements + 250 defects = 385 total CRs
- 3/00: Conducted software configuration audit: no major findings.
- 3/00: Conducted software acceptance review (SAR).
  - Zero review item discrepancies (RIDs)
  - Received 8 letters of acceptance: Rolls-Royce Corporation, Williams International, GE Aircraft Engine, Pratt & Whitney, Honeywell, Boeing, Arnold Engineering Development Center, Propulsion Systems Analysis Office NASA Glenn.

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FY00 Accomplishments (continued)

- 7/00: Completed requirements definition for Version 2: 153 requirements.

- 7/00: Conducted software requirements review: 0 RIDs.

- 8/00: Distributed NPSS Version 1.1.0 increment.
  - Change requests incorporated since NPSS 1.0.0 full version release on March 30, 2000:

    3 requirements + 14 enhancements + 39 defects = 56 total CRs

- 5/00 & 7/00: Conducted NPSS training at NASA Glenn, P&W, and Williams: over 100 engineers trained to date.

- 7/00: Completed initial draft of NPSS space transportation requirements.

- FY00: Part of ISO 9000 review for high control software.

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FY00 Accomplishments (continued)

- Automated process to track change request progress and generate statistics.

- Improved risk management and metrics collection.

- Interest and use of NPSS expanding: military, ground-based power, space, other NASA centers.

- Received positive partner evaluations: Rolls-Royce Corporation, Williams International, Lockheed, Navy.

- Feedback from partner validation activities continues to increase quality of product: GEAE internal validation, GEAE and P&W Alliance GP7000 validation.

- Number of NPSS models increase: Turbojet, Turbofan, Energy Efficient Engine, High Speed Research, Pulse Detonated Engine, partner & PSAO models, Regenerative Rocket Cycle.

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NPSS Version 1.0.0 Capabilities

NPSS Version 1.0.0 can be used as an aerothermodynamic 0-dimensional cycle simulation tool:
- All model definition through input file(s)
- NIST (National Institute of Standards and Technology)-compliant thermodynamic gas-properties packages: Therm, Janaf, GasTbl
- Sophisticated solver with auto-setup, constraints, discontinuity handling
- Steady-state and transient engine system operation
- Flexible report generation
- Built-in object-oriented programming language for user-definable components and functions
- Support for distributed running of external code(s) via the common object request broker architecture (CORBA)
- Test data reduction and analysis
- Interactive debug capability
- Customer deck generation

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NPSS Version 2.0.0 Capabilities

See NPSS SRS for detailed Version 2 requirements.

- 1-D dynamic engine system operation
- Aircraft installation effects
- Improved thermo architecture and capability
- New components, including combustion, compression, turbine expansion
- Units conversion
- Initial visual-based syntax stand-alone tools (graphical & command)
- Input and output enhancements
- Enhanced NPSS Developer Kit
- Enhanced C++ converter, interactive debugger, and commands
- CORBA Security
- NPSS running in CORBA server mode
- Common geometry interface
- Initial rockets capabilities
- Zooming from low to high fidelity as defined in the NPSS SRS
- New user documentation: Installation Guide and Training Guide

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NPSS Production Current Status

- Completing change requests weekly: requirements, defects, and enhancements.
- Supporting changes needed for partner activities.
- Sub-teams analyzing V2 requirements, prioritizing, estimating effort, assigning, and scheduling work.
- Sub-teams determining which V2 requirements and submitted change requests will be completed by 9/01 with known resources.
- Preparing for upcoming NPSS training sessions.

NPSS Production Current Status (continued)

- Improving NPSS Developer Kit.
- Prototyping CORBA Security capabilities.
- Prototyping stand-alone tools for visual-based syntax.
- Finishing NT port.
- Analyzing and designing aircraft installation effects.
- Improving user documentation.
- Enhancing C++ converter.
- Working NPSS space requirements definition.

NPSS Production Schedule

• 10/00: Complete NPSS space requirements definition.

• 10/00: Provide NPSS rockets training at MSFC and Lockheed.

• 00-01: Distribute incremental releases.

• 00-01: Provide NPSS training as needed.

• 9/01: Conduct software configuration audits for NPSS V2.

• 9/01: Conduct software acceptance review for NPSS V2.

• 9/01: Distribute NPSS Version 2 for AeroSpace.

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NPSS Development Kit

FY00 Accomplishments

Integrating Codes Through CORBA Wrapping

• **Direct FORTRAN support**
  Allows converting FORTRAN code to a CORBA object without reverting to file I/O & attendant startup/shutdown overheads.

• **Single-precision floating-point variables**

• **'Meta' variables**
  i.e., Shaft, Nmech mapped to multiple boundary conditions.

• **Variable access via functions**
  For parallel codes where the CORBA process doesn't own storage of referenced data.

• **Circumferential averaging**

• **1-D array support**
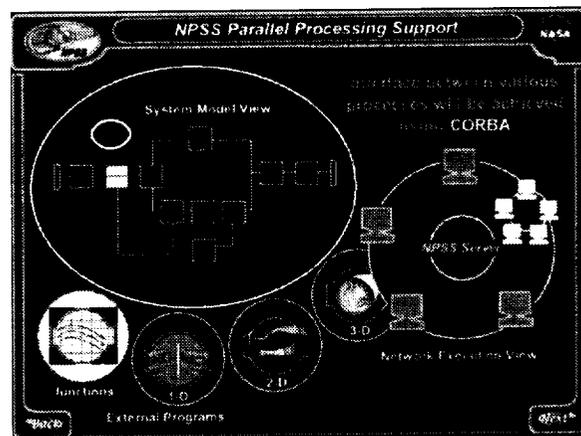
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NPSS Development Kit

FY00 Accomplishments

Coupling

- 2-D/3-D/Axi-symmetric mismatched grids, with cell or node centered data
- Interpolation method is internally unstructured, currently the only API uses structured grids
- Rolls-Royce ADPAC-NPSS-ANSYS sensitivity project

  - Will likely require unstructured support. Current interpolator has this, but API and messaging formats need to be defined
  - Likely wrap ANSYS via Java using file I/O
  - ANSYS optimizer loop to be emulated by Java client application

- Examining "best practices in coupling" for recovery into Dev. Kit
  - ASCI project coupling
  - Overflow-ANSYS
  - APNASA-TFLOW
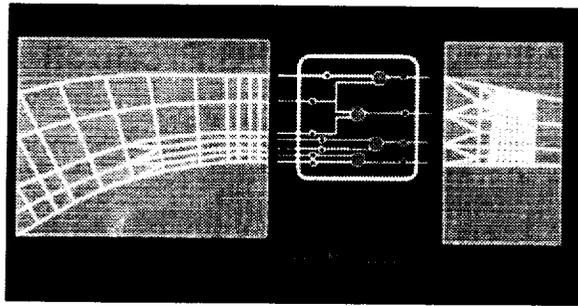
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NPSS Development Kit

FY00 Accomplishments

Zooming

- 'Natural' C++ access to remote variables

- PW 1-D zooming to compressor code
  - GRC 1-D compressor code wrapped with NPSS Dev. Kit
  - NPSS model built
  - What remains is to connect everything up

- PW 3-D/3-D zooming/coupling
  - Demonstration was expected for this meeting
  - ADPAC wrapped in NPSS Dev. Kit
  - PW, NASA code review/examination conducted to appropriate codes to wrap

- 1-D Turbine code wrapped using NPSS Dev. Kit
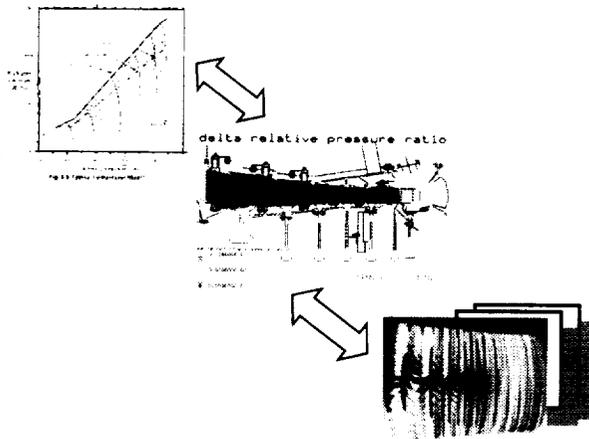
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NPSS Development Kit

FY00 Accomplishments

CORBA Security

- CORBA Security Workshop summary
    - Defined NPSS security policy
- CORBA Security Quick Start Hands-On Training Summary
    - Hitachi TPBroker SS architecture & administration GUI charts
- Defined NPSS CORBA Security testbed
    - Plans and testbed architecture
    - Purchases and network
    - Relative standards
    - Integration approach
- CORBA Security integration into NPSS schedule-3/01

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NPSS Development Kit

FY00 Accomplishments

CAD Access & Interoperability Through Common Interface

- MIT grant for CAPRI: added CV port, enhanced IDEAS port
- OMG process
    - Requirements gathering (RFI), **complete**
    - Formal RFP (CAD Services V1.0, **6/00**)
    - Vendors and end users letter of intent (LOI, **9/18/00**)
    - Vendors seek common "ground" for response
    - Develop joint submission, **1/15/01**
    - Submission reviewed and approved as standard
    - Vendor provides commercial support for the standard
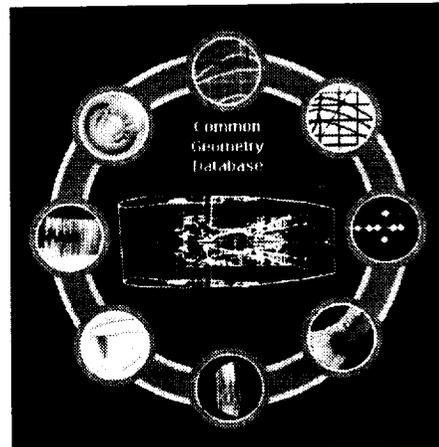
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CAPRI FY00:

	UniGraphics	ProE	I-DEAS	CATIA V4	CV	Native - Felisa
Alpha	X					X
HP	X					X
IBM RS6K	X			X		X
SGI	X	X	X	X	X	X
SUN	X					X
LINUX	X					X
Windows NT/2000	X	X			X	X

CATIA V5 will be examined during this contract, but the best approach for the programming interface is not clear. An AutoCAD geometry reader will not yet be implemented.

A CV (CompterVision's CADDS V) interface has been written in support of NPSS work with Allison/Rolls Royce and ICEM-CFD.

CAPRI FY01: Geometry Creation

The most significant change for **CAPRI** this year is the addition of Boolean operations on solids. This allows for the specification of fluid passages where the blade is the solid. The blade is simply subtracted from the passage to get the geometry for the CFD calculation. In general very complex shapes can be obtained through a few operations. The current status is as follows:

	Parasolid	ProE	I-DEAS	CATIA V4	CV
Simple Solid Creation	X			X	X
Subtraction	X		X	X	X
Intersection	X			X	X
Union	X			X	X

NPSS, OMG Shared Vision
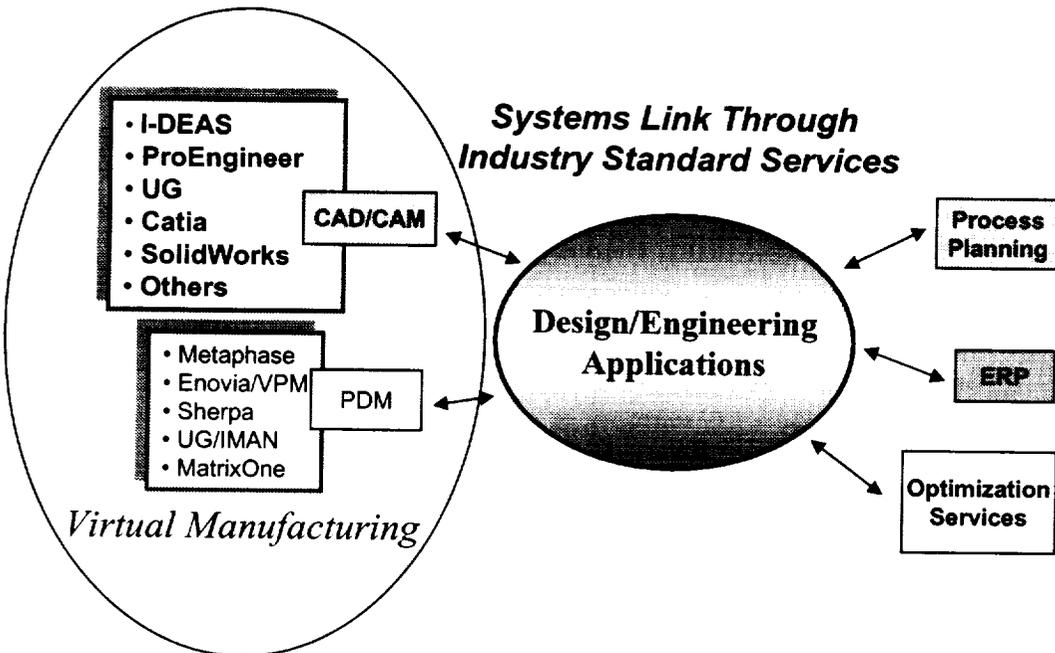
NPSS Architecture FY01 Milestones

- 1-D zooming fully incorporated into Development Kit.

- 3-D/3-D coupling of aero codes fully incorporated into Development Kit.

- Design of geometry services through CORBA-based CAPRI.

- CORBA Security services fully incorporated into Development Kit.

NPSS Architecture FY02 Milestones

- 3-D/3-D coupling of ANSYS and ADPAC wrappers incorporated into Development Kit.

- CORBA-based geometry services incorporated into Development Kit.

- CORBA Security services integrated with GLOBUS and incorporated into Development Kit.

- Fast probabilistic integration (FPI) deployed with Development Kit.

Summary

- NPSS Version 1 delivered on schedule.

- NPSS Version 2 requirements have been signed off on.

- NPSS Version 2 will include space capabilities.

- NPSS architecture products are merging into NPSS Development Kit and will be releasable through same mechanism as NPSS V.X.

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NPSS CORBA Security Development Status

RSA

NASA Glenn Research Center
NPSS Architecture Team Meeting

Tammy M. Blaser

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NPSS CORBA Security Development Status Outline

- CORBA Security Workshop (6/12-14/2000) Summary
  - NPSS Security policy charts
- CORBA Security Quick Start Hands-On Training (6/15-16/2000) Summary
  - Hitachi TPBroker SS architecture & administration GUI charts
- NPSS CORBA Security Testbed
  - Overall plans
  - Progress and purchases
    - Testbed architecture
    - Current workshop (9/21/2000)
    - Current network
  - Relative standards
  - Integration approach
- CORBA Security Integration into NPSS Schedule

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CORBA Security Workshop Summary

- CORBA Security Workshop was taught by Concept Five and assisted by Hitachi, hosted at NASA Glenn, on June 12-14.
- GEAE, P&W, and NASA Glenn attendees.
- Workshop was very successful.
- Day One was a very good CORBA Security and associative security technologies overview.
- By the end of Day Three, the Team had developed an NPSS specific security domain policy.

CONCEPTFIVE

Option 1 for NPSS Domain Hierarchy
Domain Access Control Policy
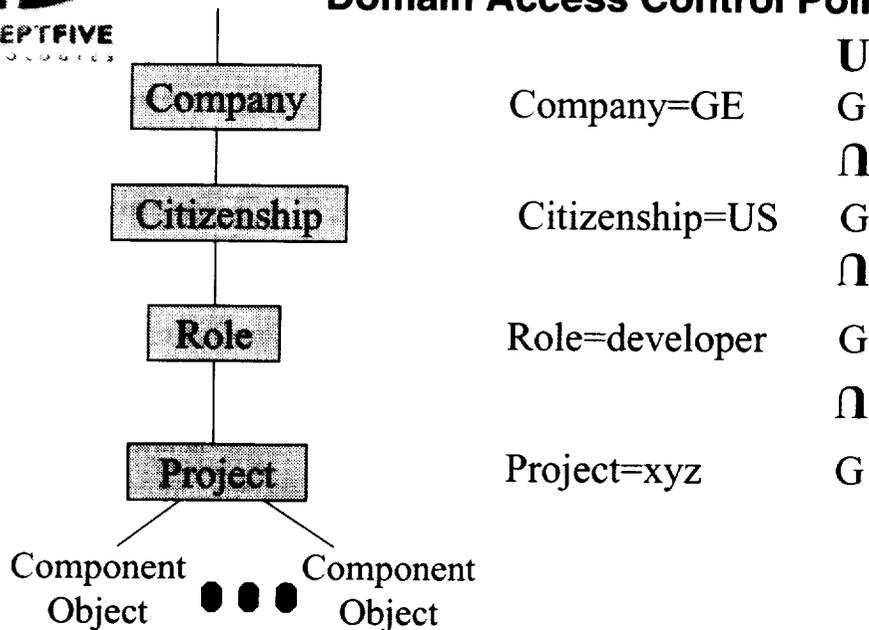
Hierarchy	Policy	
Company	Company=GE	U G
Citizenship	Citizenship=US	$\cap$ G
Role	Role=developer	$\cap$ G
Project	Project=xyz	$\cap$ G

Component Object ● ● ● Component Object

Option 2 for NPSS Domain Hierarchy
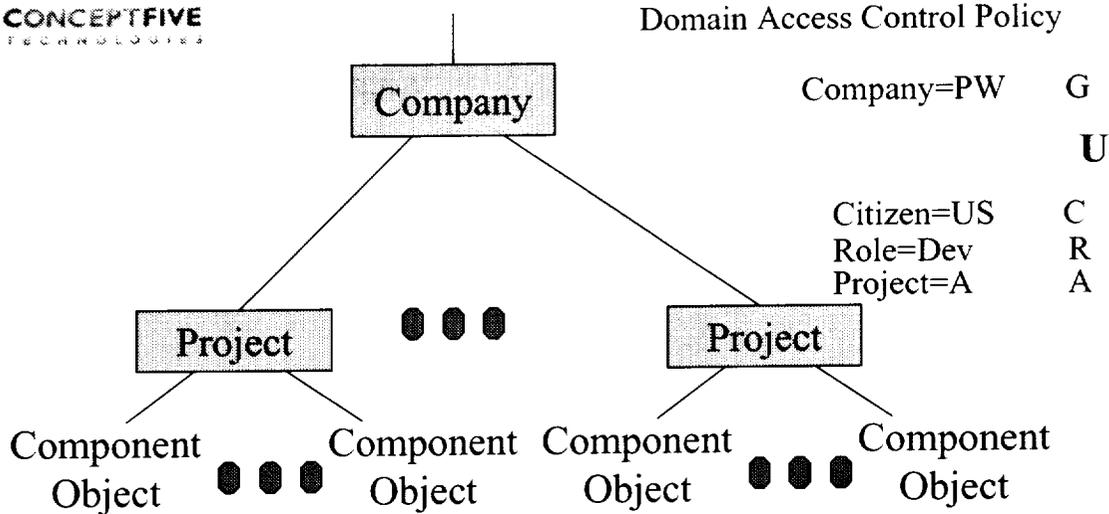
CONCEPTFIVE

Domain Access Control Policy

Company=PW   G

U

Citizen=US   C
Role=Dev   R
Project=A   A

Company

Project ● ● ● **Project**

Component   Component   Component   Component
Object ● ● ● Object   Object ● ● ● Object

2000 NPSS Review

Interfaces and Required Rights

CONCEPTFIVE

Interface	Req. Rights	Admin	Dev/User	User
get_private	GCRP	✓	✓	✗
get_public	P	✓	✓	✓
set_private	GCRP	✓	✓	✗
set_public	P	✓	✓	✓
execute	U	✗	✓	✓
list_private	GCRP	✓	✓	✗
list_public	P	✓	✓	✓

2000 NPSS Review

Attributes and Domain Hierarchy

Attributes

ID

Company

Citizenship

Role

Division

Project

Domain Hierarchy
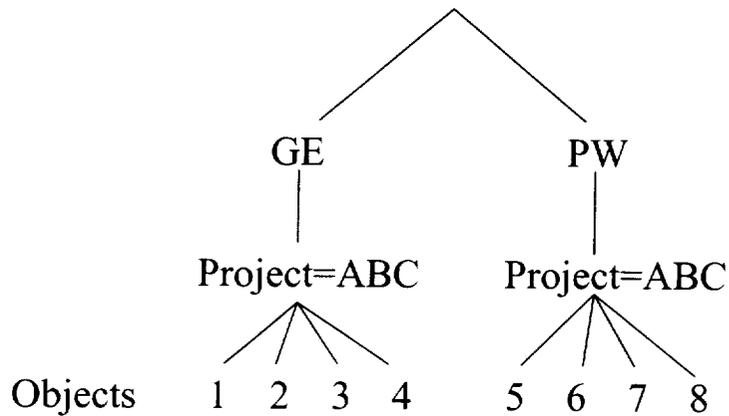
```
                    /\
                   /  \
                  /    \
                GE      PW
                 |       |
          Project=ABC   Project=ABC
              /|\          /|\
             / | \        / | \
Objects   1 2 3 4      5 6 7 8
```

Domain Policy

Domain GE			**Domain PW**	
Company=GE	G		Company=PW	G
Domain GE/ABC			**Domain PW/ABC**	
Citizen=US	C		Citizen=US	C
Citizen=Can	C			
Role=User	U		Role=User	U
Role=Dev	R,U		Role=Dev	R,U
Role=Admin	R		Role=Admin	R
Project=ABC	P		Project=ABC	P

Examples

- User A = PW, US, Dev, ABC
  - In GE/ABC: CRPU - can execute and access public variables in GE.
  - In PW/ABC: GCPRU - can execute and access public and private variables in PW.
- User B = GE, Can, User, ABC
  - In GE/ABC: GCUP - can execute and access public variables in GE.
  - In PW/ABC: UP - can execute and access public variables in GE.

CORBA Security Quick Start Hands-On Training Summary

- CORBA Security Quick Start Hands-On Training Summary was taught by Hitachi and assisted by Concept Five, hosted at NASA Glenn, on June 15-16.
- P&W and NASA Glenn attendees.
- Hands-On Training was very informative.
- Instructors were very good about answering many ad-hoc questions.

CORBA Security Quick Start Hands-On Training Summary (continued)

- The three labs consisted of creating
  - A user using the security policy administration GUI.
  - A secure system using the TPBroker Security Service.
  - A secure system exercising delegation using the TPBroker Security Service.

HITACHI
SOFTWARE

Interceptor-Based Implementation

IIOP (TPBroker)

SSL (VisiBroker SSL-pack)

HITACHI SOFTWARE   Security Policy Administration (Interface)

Security Policy Administration
(Domain Access Policy)
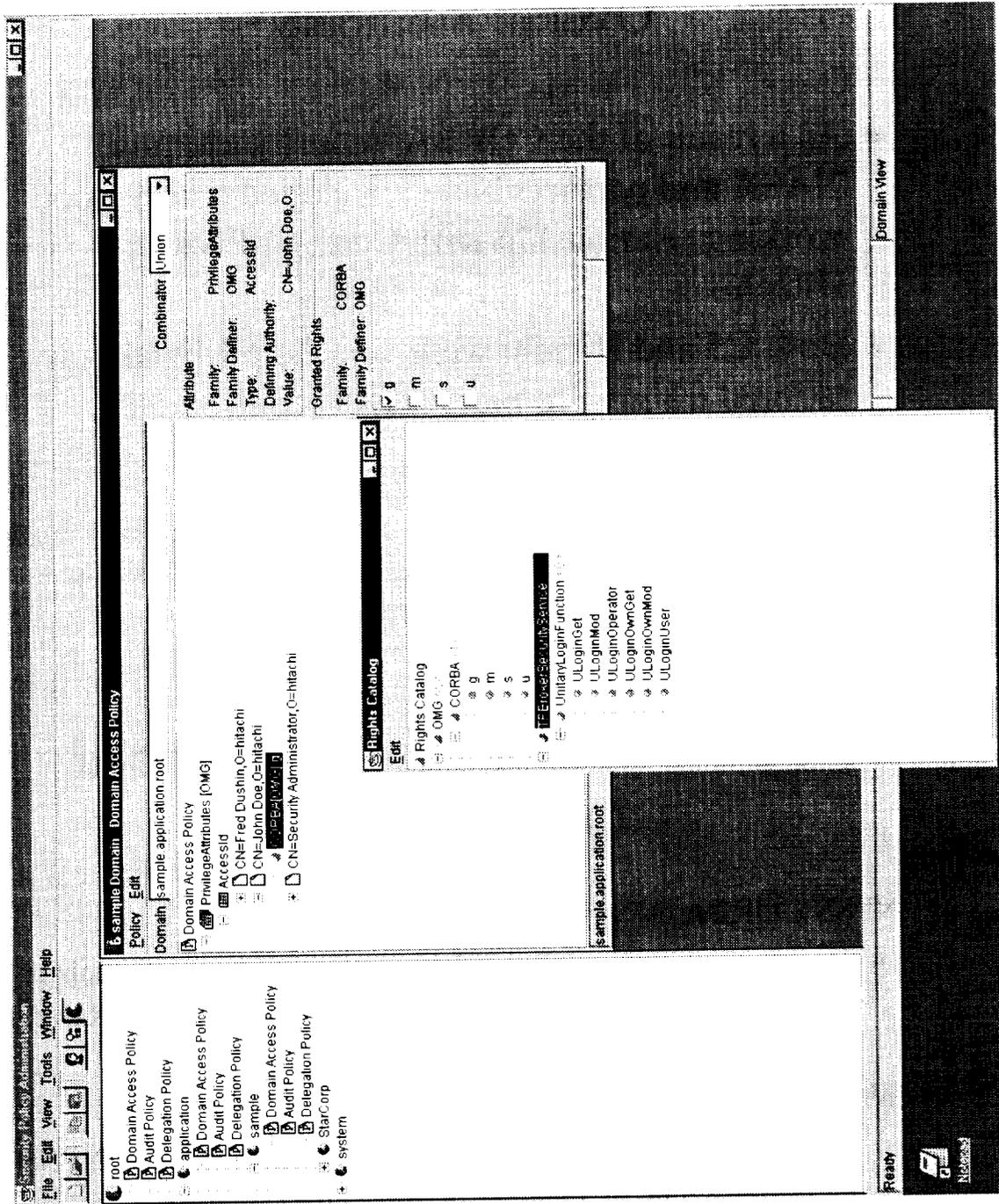
CORBA Security Workshop CORBA Security Quick Start Hands-On Training Overall Summary

- As a result of the CORBA Security training, NASA and partners have developed a very good working relationship with Concept Five and Hitachi.
- Both C5 and Hitachi were very helpful and tailored training to meet NPSS requirements.

2000 NPSS Review

NPSS CORBA Security Testbed Overall Plans

- NPSS CORBA Security Testbed Development
  - Develop a NPSS CORBA Security testbed with Hitachi's TPBroker Security Service (SS) via a dedicated CORBASec network with GEAE and P&W.
- Wrap Codes Development
  - Wrap simulation codes, integrate and retest into the NPSS CORBA Security testbed.

2000 NPSS Review

NPSS CORBA Security Testbed Architecture

Hitachi's TPBroker Security Service available now - Iona's OrbixSec in work
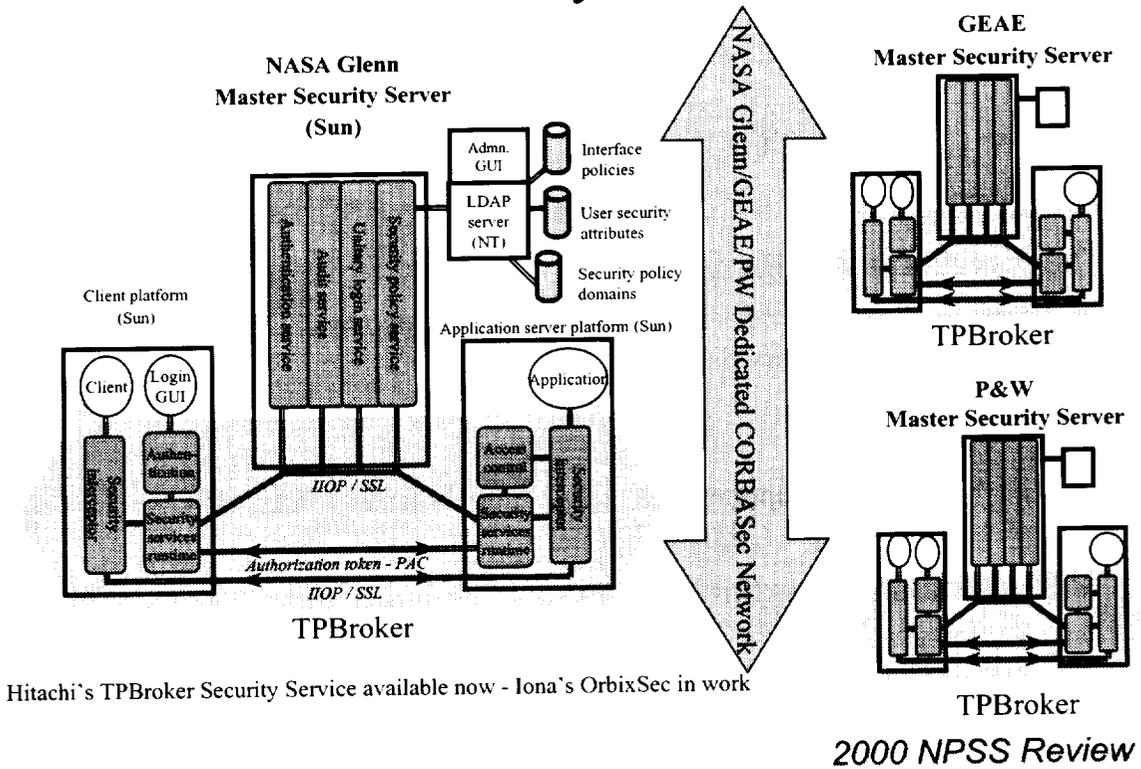
NPSS CORBA Security Testbed Progress and Purchases

- Weekly or as-needed NPSS CORBASec testbed telecons are held with GRC, GEAE and PW.

- NASA Glenn has a purchase request in the procurement system to purchase three Ultra 5 Sun computers.
  - Will ship date 9/28/2000

- At the beginning of the new FY01
  - An existing ACCL PC will be upgraded.
  - Hitachi TPBroker SS & Netscape LDAP s/w will be purchased.
  - NASA Glenn currently making due with borrowed h/w and eval s/w until FY01 start.

- GEAE and PW are also starting to configure their testbeds.

NPSS CORBA Security Testbed Progress - Current Workshop

- GEAE will host the CORBA Security Technology Day Workshop; Hitachi, GRC and PW attending on 9/21/2000.
  - The workshop will focus on
    - Hitachi's plans to support the portable object adaptor (POA) with ports of the TPBroker Security Service to
      - VisiBroker v.4.x
      - Orbix 2000
    - Hitachi's plans to support Java and C++ for Solaris, Linux, HPUX-11
    - NPSS CORBASec testbed update
    - Update on needed security features
      - SecurID
      - Certificate authentication

NPSS CORBA Security Testbed Progress - Current Network

- Investigating current NASA, GEAE and PW networks and feasibility to modify them to develop NPSS CORBASec testbed.
  - May be able to extend current NASA Dryden and GEAE encrypted network to NASA Glenn.
  - PW looking into their current networks as well.
- NREN approach was not recommended by NASA Glenn network POCs because of our March 2001 milestone.
- Idea is to use a dedicated network and focus on security software configurations.
  - Will switch back to NASA Glenn and company networks with firewalls in the final integration and test phase.

NPSS CORBA Security Testbed Relative Standards

- Stay up to date on the following standards and implementations:
  - Common Secure Interoperability level 2 (CSI v.2)
    - Required to interoperate between different secured ORBs: TPBroker, Orbix, Mico, Visibroker.
  - CORBA Component Model (CCM) and Enterprise Java Beans (EJB)
    - Standards coming together, and the future.
  - Domain Membership Management (DMM)
    - DMM and portable object adaptor (POA) integration.
  - Portable Interceptors
    - Plug 'n Play different security products together – replaceability.

2000 NPSS Review

NPSS CORBA Security Testbed Integration Approach

- Wrap codes development
  - Wrap simulation codes, integrate and retest into the NPSS CORBA Security testbed.
  - Interface with CORBA IPG and NPSS Production Teams.
- Integrate with existing legacy simulation's external security system with *single login* by utilizing the Unitary Login feature (not part of CORBAsec standard, currently)
- Integrate SecurID features
- Integrate Concept Five's PKI Certificate Login into
  - Existing TPBroker SS s/w login; GUI is ID/password-based.
  - Goal is to smooth the integration of Entrust PKI when fully implemented by all certificate authorities (CA) using CA cross-certification; including NASA Centers, P&W, etc.

2000 NPSS Review

CORBA Security Integration into NPSS Schedule

- GEAE host CORBA Security Technology Day Workshop September 21, 2000.
- Finalize overall testbed network configuration - October 2000.
- Configure NASA Glenn testbed site with new Sun Ultra-5s and TPBroker SS s/w - October 2000.
- Conduct preliminary tests - November 2000 at local sites only.
- Conduct secured CORBA wrapped tests w/all sites - December 2000.
- Add additional security features for legacy systems, SecurID, PKI Certificate Login etc. - January 2000.
- Develop NPSS CORBA Security Development Kit or update existing CCDK based on findings of testbed - February 2001.
- Conduct final tests - February 2001.
- Start NPSS CORBASec <u>Production</u> development & verification planning - March 2001.

2000 NPSS Review