PET CSM Program Review

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NCSA CSM Team

Harry Hilton	**ASC Senior Academic Lead**
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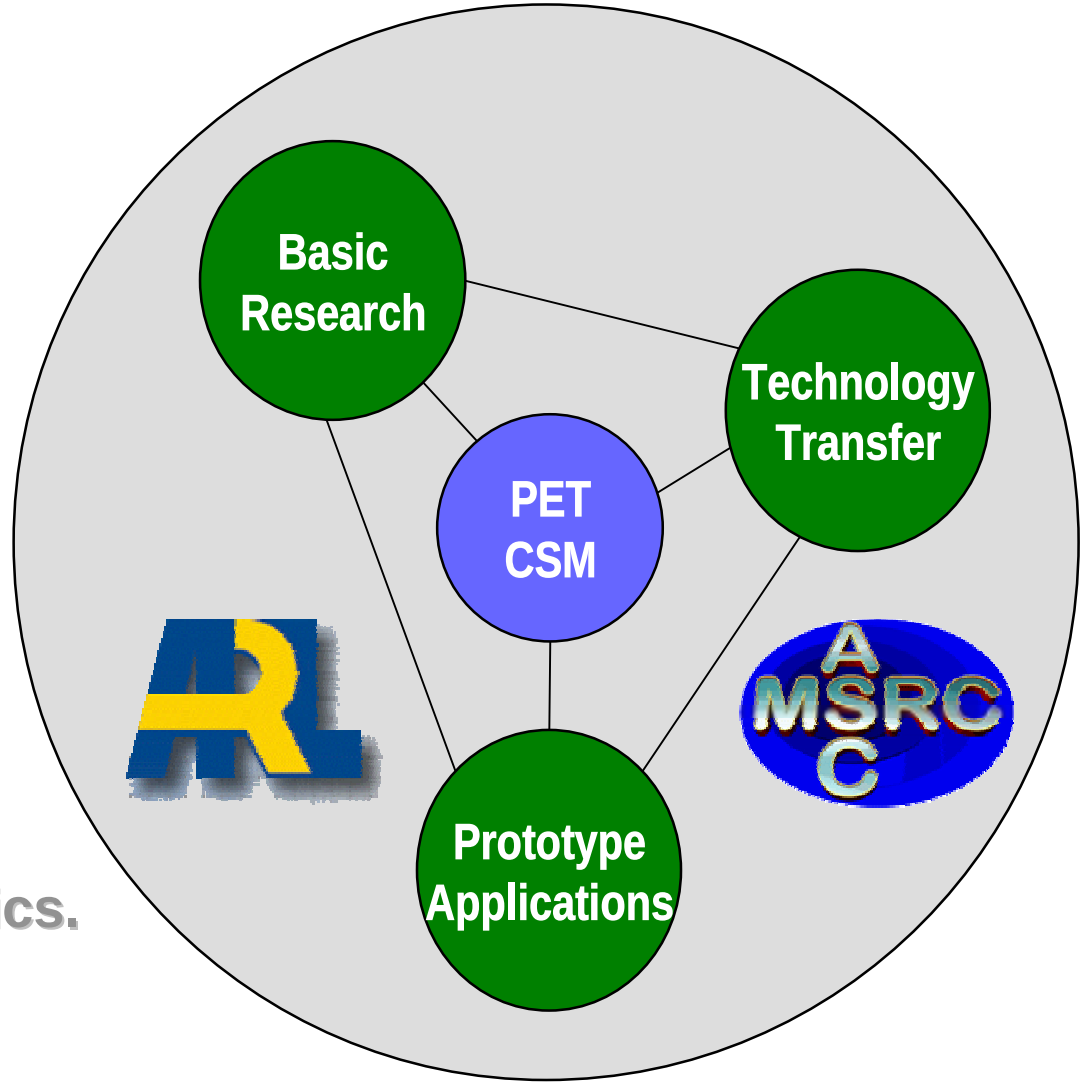
LeRay Dandy	**Group Coordinator**
Cristina Beldica	**Research Scientist**

websites ***www.ncsa.edu/SCD/Science/PET***
www.asc.hpc.mil/PET/CSM
www.arl.mil/Pet/CSM

Core Support

The goal of the PET CSM team is to provide support and direction to researchers working in the field of solid mechanics.



Projects that target the work of specific groups and the community at large are defined and advanced in pursuit of this goal.

Overview

Basic Research

Project Definitions

Computational Methods

Highlights

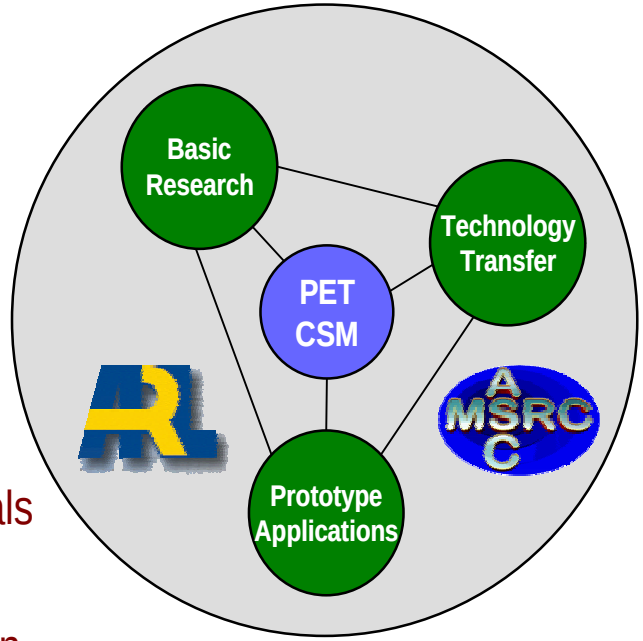
30 Conference Presentations

60 Journal and Proceedings Papers

Aerostructures and Composite Materials

Impact and Penetration Modeling

Performance Analysis and Optimization



Technology Transfer

Integrated Web Service

Software Evaluation and Review

Educational Outreach

Highlights

Application Training/Demos

CSM Seminars

MAPINT, Supercomputing,

DoD HPC Users Conferences

Prototype Application Development

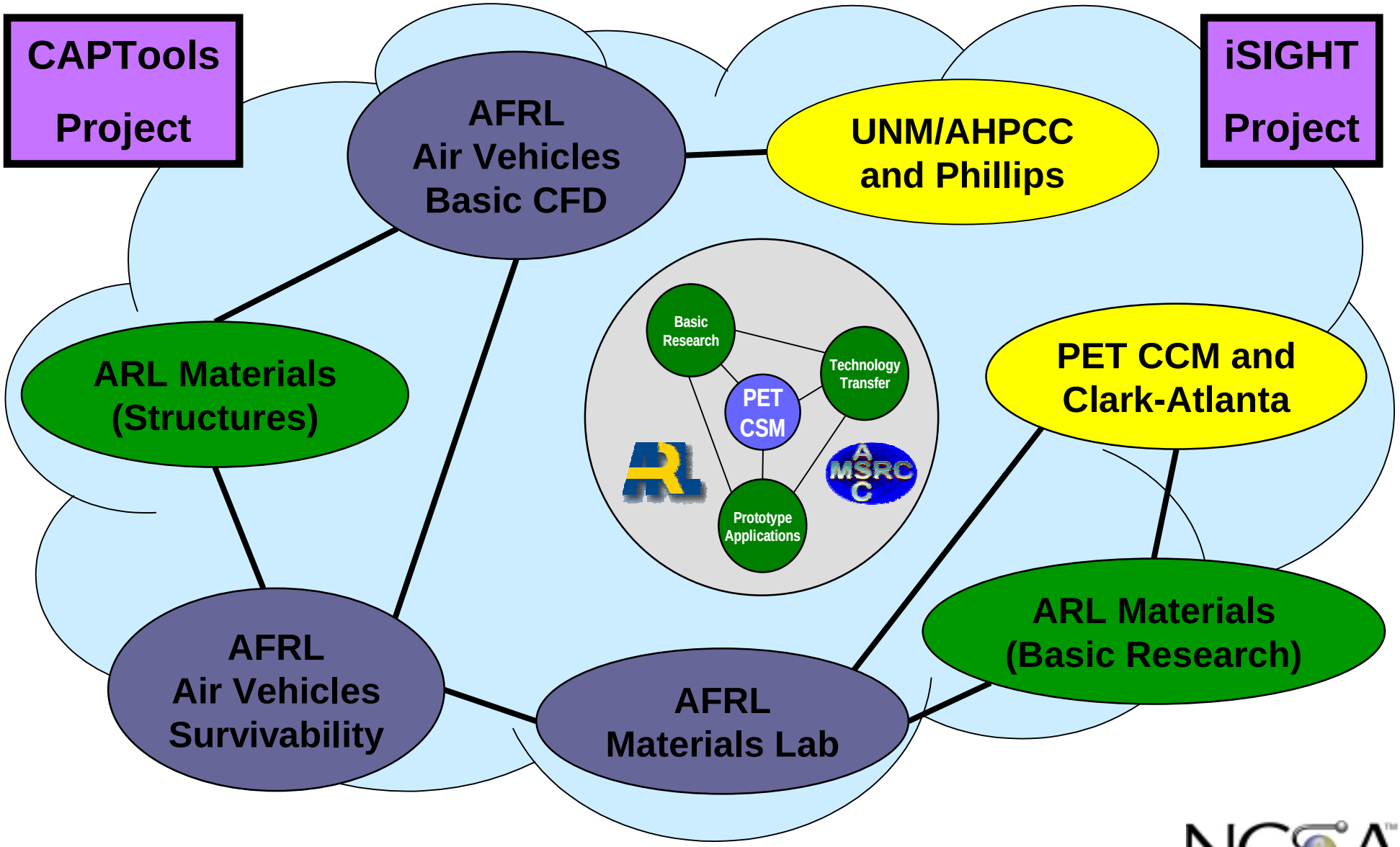
HPC Community Projects, Software Evaluation and Acquisition,

Targeted CSM and Multidisciplinary Collaborations

Highlights

AFRL, ARL, Phillips Lab/UNM, CCM/Clark-Atlanta, Tools/UGreenwich

Prototype Application Development



iSIGHT Project

- **Multidisciplinary Optimization Framework**
  - Problem Solving Environment for Coupling User Codes, COTS Software, etc.
  - Local and Remote Task Coordination
  - Integrated Optimization Logic
  - "Free" University Program
- **Strong Strategic Partner Group**
  - Direct Participation in Development Process
- **Enterprise Licensing**
  - Added Flexibility in Resource Allocation
  - Initial and Perpetual Cost Savings
  - Cooperative Licensing Arrangement with ARL MSRC
- **Training**
  - First On-Site Workshop Presented the Week of September 20, 1999

www.engineous.com

CAPTools Project

- **Collaboration with the University of Greenwich, NASA Ames and Programming Tools**
  - Initiated in October 1998
  - Budget for Development Steering
  - Software Evaluation and Training, Pioneer Deployment

the UNIVERSITY of GREENWICH

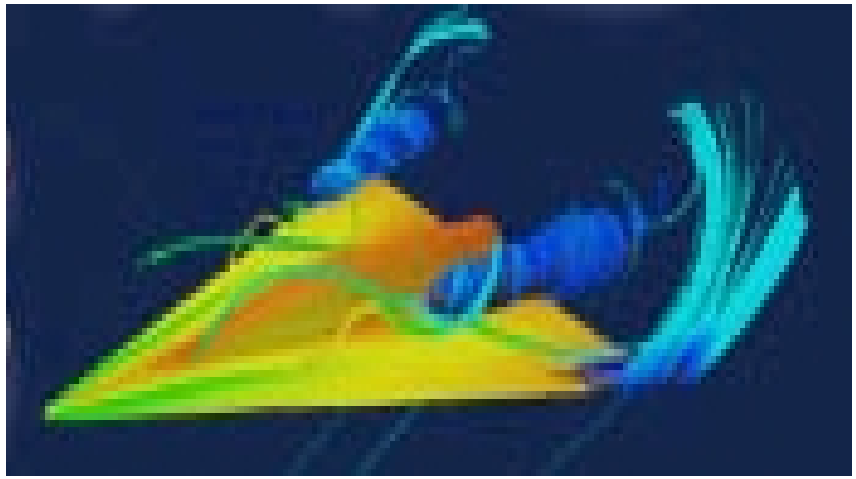
www.captools.gr.uk

- **FORTRAN Source Code Parallelizer**
  - Automatic Dependency Analysis
  - Explicit Message Passing and OpenMP Code Generation
  - Potential for New Development as well as Legacy Code Modernization
  - Free Beta Program

- **Evaluation In Progress**
  - Preliminary Results Presented at the 1999 DoD Users Group Conference
  - Final Experiments Currently in Progress (SC99 targeted for presentation)

AFRL Basic CFD Research

Structural Solver for FDL3DI CFD Code



M. Visbal, R. Gordnier (AFRL)

L. Dandy, C. Beldica, D. O'Neal, D. Semeraro (NCSA)

AFRL Basic CFD Research

Project Goals

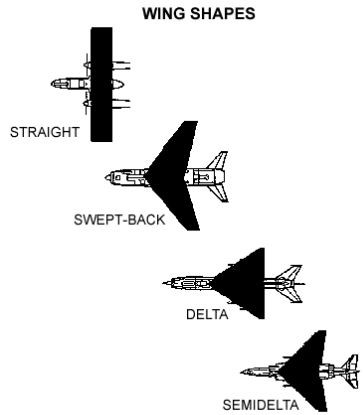
- Develop compact, portable 3D FEM structural solver to predict aircraft response to aerodynamic loads
- Integrate structural solver into high fidelity CFD code replacing a 1D modal solver
- 3D visualization of fluid-structure response

Significance

- Solver can be ported to other DoD applications
- Capitalizes on existing AFRL technology

AFRL Basic CFD Research

Parametric Finite Element Model of an Aircraft Wing



M. Visbal, R. Gordnier (AFRL)

L. Dandy, C. Beldica, D. O'Neal, G. Kwak (NCSA)

AFRL Basic CFD Research

Project Goal

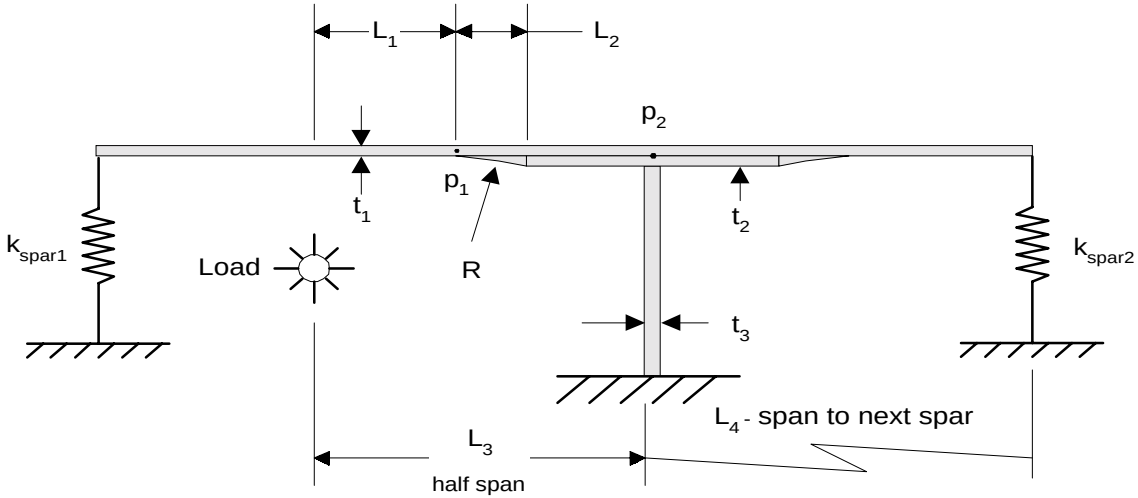
- Develop parametric finite element model generator designed to build structural models of military aircraft wings from control point data using COTS package

Significance

- Permits non-CSM researchers to create structural models for basic research
- Can be used by other agencies for designing airfoils

AFRL Air Vehicles Survivability

Parametric Model for Analyzing Spar/Skin Attachment Geometry



A. Mayer, G. Czarnecki, J. Calcaterra (AFRL)

C. Beldica, L. Dandy, D. O'Neal, Y. Woo (NCSA)

AFRL Air Vehicles Survivability

Project Goals

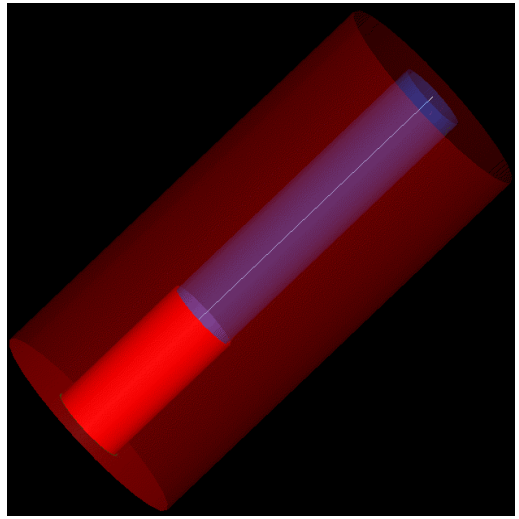
- Analysis of spar-skin attachment geometries
- Survivability optimization

Significance

- Precursor to 3D simulation
- Potential cross-MSRC project
- Uses COTS optimization framework (iSIGHT)

AFRL Materials Lab

The Axisymmetric Damage Model



N. Pagano, G. Shoeppner (AFRL)

G. Tandon (AdTech Research Systems)

D. O'Neal (NCSA) and K. Flurchick (OSC)

AFRL Materials Lab

Project Goals

- Investigate alternative approaches capable of eliminating requirement for 128-bit FP; assist with followup redesign, validation and benchmarking efforts
- Implement OpenMP port

Significance

- Used to establish design properties of experimental composite materials
- Proposed alternative solution method is expected to yield better than a 100-fold increase in performance

Closing Remarks

- **Basic Research, Technical Writing and Conference Participation are Valuable Tech Transfer Mechanisms**
  - **Predicting return on investment for basic research projects can be difficult**
- **Prototype Development is Critical to Program Success**
  - **Overcomes inertia and parts of shrinking budgets**
- **CSM Leading Way in Multidisciplinary Collaborations**
  - **1 project completed (Survivability)**
  - **2 projects on the verge of completion (FDL3DI Solver, Parametric Wing)**
  - **4 others in-progress (iSIGHT, CAPTools, UNM/Phillips, Multiscale)**
- **Maintain Consistency with Gateway Project Goals**