

The OpenVSP ModelCenter Plug-In

Second OpenVSP Workshop

August 9, 2013



PHOENIX
INTEGRATION

DESIGNPROCESSOPTIMIZATION

Agenda

- Phoenix Integration
 - Who are we?
 - Phoenix Integration ModelCenter and Analysis Server
- OpenVSP PlugIn
- OpenVSP PlugIn Demo
- What's next?
 - The next PlugIn demo

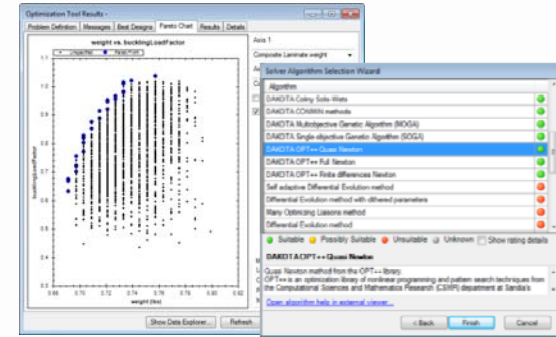
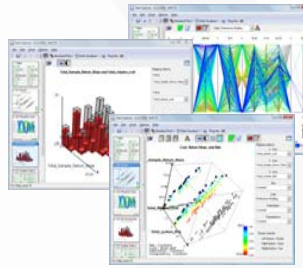
Phoenix Integration

- Provide engineering software and services to customers in aerospace, defense, and related industries
- 16 year history
- Evolved out of a research program at Virginia Tech
- Office locations
 - Philadelphia, PA (Corporate)
 - Blacksburg, VA (R&D)
 - California (Sales)
 - North East (Sales)
 - Toulouse, France
- World-wide sales in North America, Europe, and Asia



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Phoenix Integration ModelCenter System Level Capabilities



1 Integration

- “Open”, adaptable, vendor/tool agnostic environment for Hi/Lo fidelity models & simulations; for leading COTS, GOTS, internal
- Distributed analysis over a network to access multi-disciplinary models as needed

2 Visualization

- *Find Better Designs; *Leverage for design review to get everyone on the same page
- Stakeholder-friendly views, Dashboards, Free Viewer, etc to bridge communication gaps among technical and sponsor collaborators

3 Automation

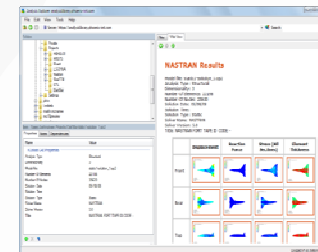
- “What if” analysis tools for better understanding of tradespace -> cost reductions, improve quality..
- 100s or 1000s more alternatives in same time vs. traditional methods
- Design Exploration, Optimization,
- Surrogate Modeling, Uncertainty/Reliability

4 Model Based Systems Engineering (MBSE)

Bi-directional modeling and requirements integration

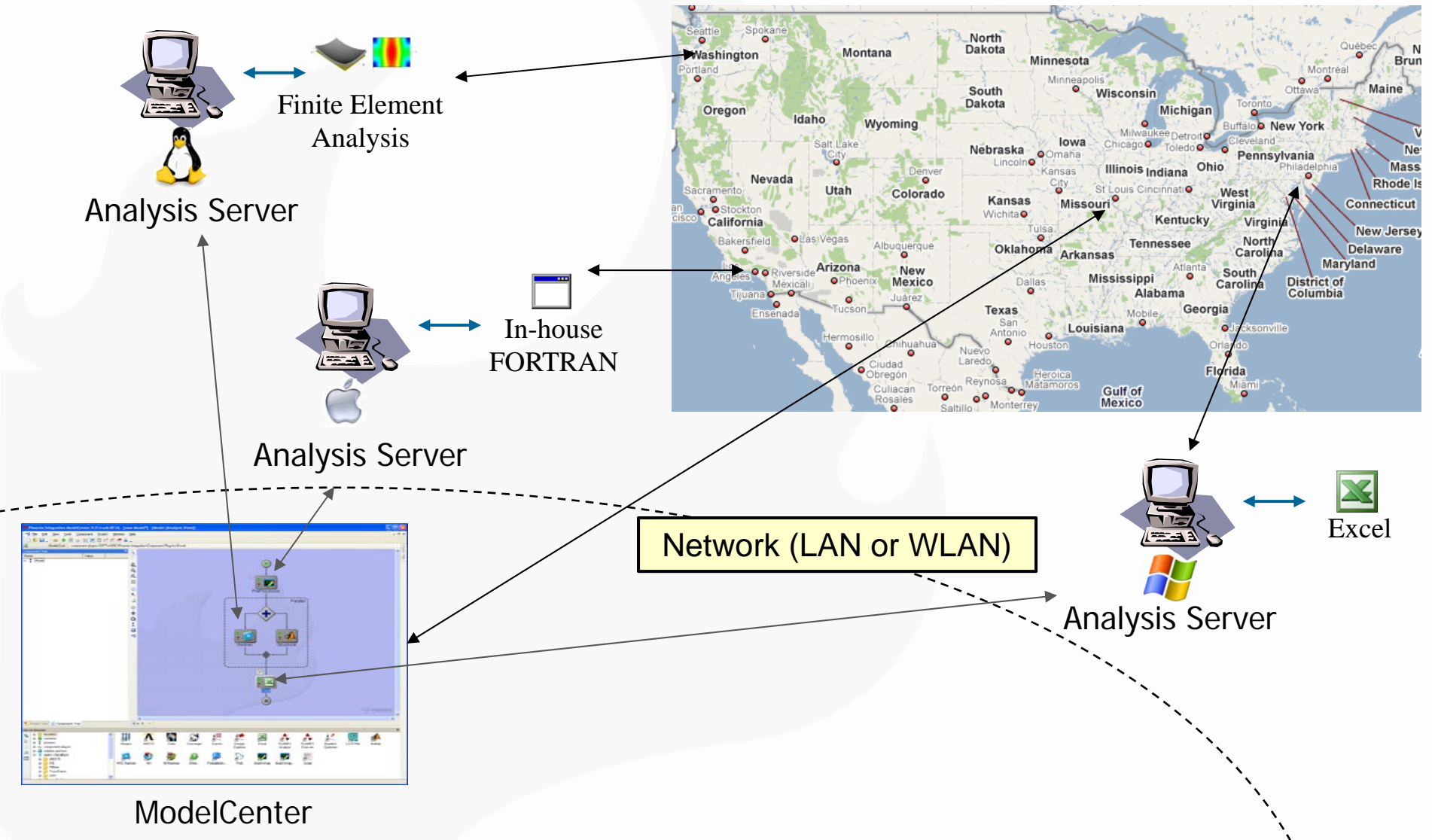


5 Data Management, HPC



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Analysis Server



Modeling and Simulation Tools

Vendor-Neutral Infrastructure that can integrate almost any code



SolidWorks

Product Design

- Given design parameters, predicts performance characteristics:
 - How much will it weigh?
 - How high can it fly?
 - What will it cost?
- Useful for designing hardware
- Wrap your code or use plug-ins:



• Matlab



• Mathcad



• Excel



• CAD



• Abaqus



• ANSYS



• Fluent



• Price



• Seer



• Nastran

Simulation

- Given performance characteristics, predicts how a system will react to various stimulus over time:
 - Hit rate?
 - Access times?
 - Throughput?
- Useful for designing systems
- Wrap your code or use plug-ins:



• Flames



• STK



• OpNet



• ProModel

Arena • Arena



• Simulink



• Extend



• Vensim

Optimization Algorithms

- Nelder-Mead
- Hooke-Jeeves
- EVOLVE
- SwarmOps
 - Differential Evolution method
 - Differential Evolution method with dithered parameters
 - Self adaptive Differential Evolution method
 - Local Unimodal Sampling method
 - Many Optimizing Liaisons method
 - Pattern Search method
 - Particle Swarm Optimization method
 - Random sampling method
- DOT
 - Broydon-Fletcher-Goldfarb-Shanno (BFGS) variable metric method
 - Fletcher-Reeves (F.R.) conjugate gradient method
 - Modified Method of Feasible Directions (MMFD)
 - Sequential Linear Programming (SLP)
 - Sequential Quadratic Programming (SQP)
- BIGDOT
 - Sequential Unconstrained Minimization Technique (SUMT)
- DAKOTA
 - Asynchronous Parallel Pattern Search
 - Coliny COBYLA
 - Coliny DIRECT
 - Coliny Evolutionary Algorithm
 - Coliny Pattern Search
 - Coliny Solis-Wets
 - CONMIN methods
 - Multi-objective Genetic Algorithm (MOGA)
 - NCSU DIRECT
 - OPT++ Polak-Ribiere conjugant gradient
 - OPT++ Finite differences Newton
 - OPT++ Full Newton
 - OPT++ Parallel direct search
 - OPT++ Quasi Newton
 - Single-objective Genetic Algorithm (SOGA)
- Boeing
 - Design Explorer
 - SQP Gradient Optimizer
- Darwin
- NSGA II



The new architecture makes it very easy to add additional algorithms

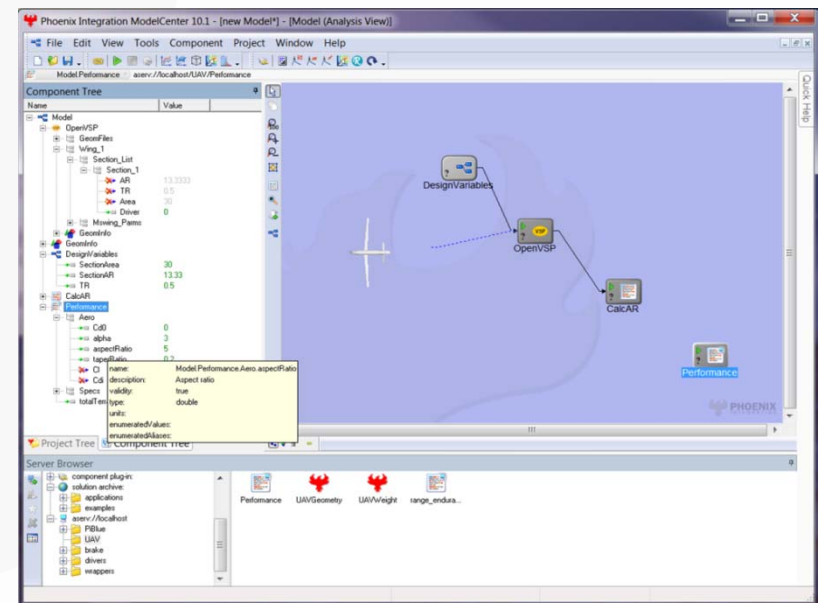


Probabilistic Methods

Method	Type	Comments
FORM – First Order Reliability Method	Most Probable Point based	An efficient method which uses first order approximation of response function thus will be less accurate for highly non linear functions.
MV – Mean Value	Most Probable Point based	Most efficient and basic method not very accurate generally, used to get a feel of the response function.
AMV+ - Advanced Mean Value with Iterations	Most Probable Point based	More accurate than MV method and tries to converge on MPP. Efficient and highly accurate results if convergence is obtained.
EGRA – Efficient Global Reliability Analysis	Surrogate based/Sampling	A very accurate and highly efficient method which does sampling on Gaussian Process model of response function. Highly accurate for low probability and low variable cases.
Monte Carlo	Sampling	This method should be used to supplement other efficient methods to gain experience and confidence in those efficient methods. Provides good results always but at the cost of very high number of model evaluations, sometimes up to a million.

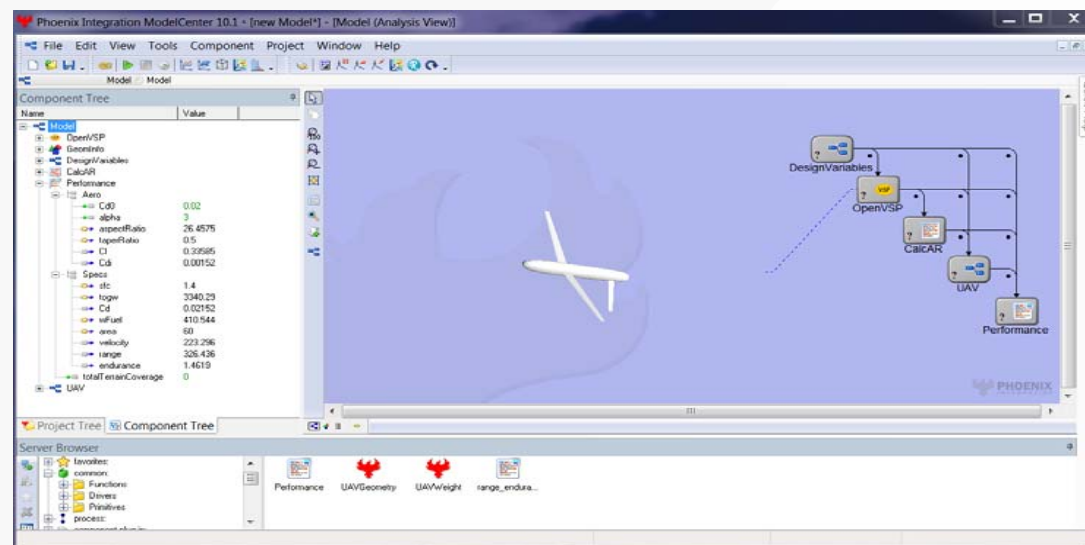
The OpenVSP Plug-In

- OpenVSP provides geometry in a larger design context
 - Quick and easy manipulation of geometric parameters, access to calculated values, as well as geometry definition files is critical in the design process
- Integration of OpenVSP as a plug-in is a no-brainer
 - ModelCenter and Analysis Server provide the MDO framework as well as the design exploration tools
 - OpenVSP provides the rich parameterized geometry



What does the OpenVSP Plug-in do?

- The OpenVSP Plug-in meets four specific goals:
 - Expose OpenVSP parameters in ModelCenter
 - Expose calculated OpenVSP outputs in ModelCenter
 - Export geometry file such that it can be passed to other analyses within a ModelCenter framework
 - Display the OpenVSP geometry





OpenVSP Plug-in Demo

Current status

- The OpenVSP plug-in is currently in beta
 - Next iteration/version will utilize the new API
 - Demo of a new UI addressing issues found in current version
- I have a tutorial and a flash drive of our software available if you'd like to play/try it
 - ModelCenter, Analysis Server and the OpenVSP PlugIn
 - Demo licenses till then end of the month
- We rely on feedback from users to improve our products



NEW UI FOR THE NEXT VERSION

Questions?

- To get a copy of the plug-in, contact Andy Ko:
 - Email: ako@phoenix-int.com,
 - Phone: (540)961-7215 x302

