

Transition

An example of Air Force supported SBIR/STTR technology that has been transitioned into an Air Force or other DoD system or subsystem or used by Air Force test ranges and facilities or maintenance depots.

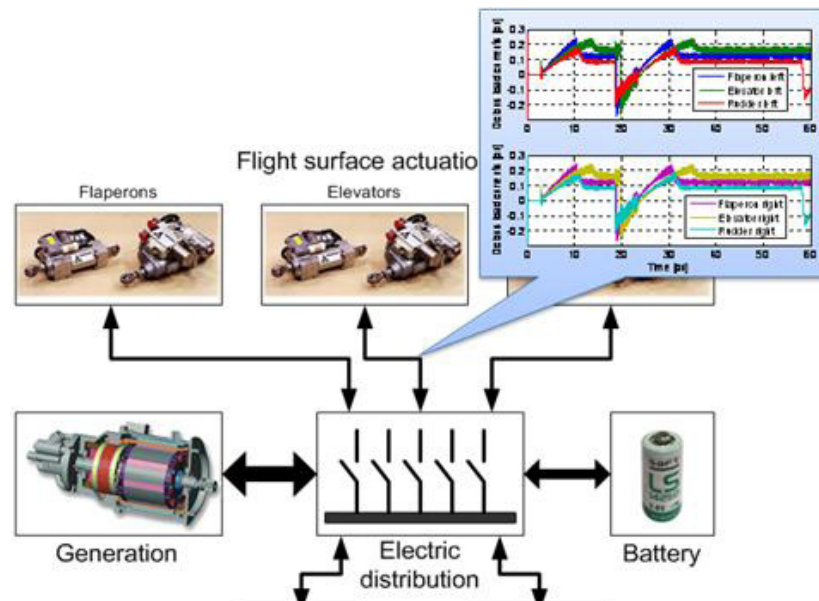
SBIR Topic Number:
AF03-173

SBIR Title:
Aero Propulsion and
Power Technology

Contract Number:
FA8650-04-C-2482

SBIR Company Name:
PC Krause and
Associates, Inc.,
West Lafayette, IN

Technical Project Office:
AFRL Propulsion
Directorate, Wright-
Patterson AFB, OH



Variable-Fidelity Multi-Physics Modeling, Simulation, and Analysis Capability

- The Air Force has a requirement for a variable-fidelity multi-physics modeling, simulation, and analysis capability
- PC Krause and Associates, Inc. (PCKA) developed two key technologies – a partitioned finite-element (FE) technique and a variable-fidelity multi-physics simulation infrastructure – to facilitate modeling, simulation, and analysis for support of the design and optimization of large-scale systems
- These technologies were selected for use in the Air Force Research Laboratory’s Integrated Vehicle Energy Technology (INVENT) Demonstration Program involving 12 companies and two government facilities
- In addition, the state of Indiana awarded PCKA a grant to enhance these technology capabilities from engineering tools to commercial software

Commercialization Pilot
Program Series

RZ09-0517

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Air Force Requirement

The Air Force has a requirement for a variable-fidelity multi-physics modeling, simulation, and analysis capability that accurately accounts for dynamic interactions between subsystems and promotes collaboration between individual groups and organizations involved in the design, development and optimization of large complex systems.

Such a capability shall (1) protect individual subsystem manufacturer's proprietary data, (2) be computationally efficient, and (3) enable system-level integration and optimization.

SBIR Technology

In this SBIR effort, PC Krause and Associates, Inc. (PCKA) developed two key technologies in modeling, simulation, and analysis for support of the design and optimization of large-scale systems.

The first of these key technologies is a partitioned finite-element (FE) technique wherein computation times for transient FE models have been reduced 30 fold when compared to a commercial FE simulator and has been applied to permanent-magnet, switched-reluctance, and wound-rotor synchronous machines. This increase in computational speed has enabled FE models to be integrated with circuit simulations as part of a design optimization algorithm wherein tradeoffs can be rapidly evaluated in a systematic search for a globally optimal design.

The second technology is a variable-fidelity multi-physics simulation infrastructure that enables the user to select between finite-element models that may require hours to days of simulation time through constructive (algebraic) models that may execute hundreds to thousands of times faster than real time.

These innovations coupled with PCKA's previous SBIR technologies, Distributed Heterogeneous Simulation (DHS) and the Automated State Model Generation (ASMG), have enabled PCKA to develop the required variable-fidelity multi-physics modeling, simulation, and analysis environment.

Transition Impact

This environment and its associated benefits were applied to a directed energy system involving two companies and two Air Force Directories. For this system, the size (weight/

volume) and cost were significantly reduced through the use of this multi-discipline integrated system optimization. As a result of this success, these technologies were selected as the modeling, simulation, and analysis tools for the Air Force Research Laboratory's Integrated Vehicle Energy Technology (INVENT) Demonstration Program involving 12 companies and two government facilities.

These tools have already been transitioned to several of the participating organizations. In addition, the state of Indiana awarded PCKA a \$2 million grant in late 2007 to enhance these capabilities from engineering tools to commercial software. This enhanced version of the tool is called FastSim and is scheduled for release in late 2009.

Company Impact

When this SBIR Phase I contract was awarded in 2003, PCKA had two full-time and five part-time employees. Presently, PCKA has grown to 23 full-time employees. The majority of this growth is directly related to this SBIR project.

PCKA supports several programs and research initiatives for various government agencies and numerous industries. The company has a well established reputation for solving engineering challenges through the use of advanced modeling, simulation, analysis, and control techniques.



SBIR/STTR

Air Force SBIR Program
AFRL/XP
1864 4th Street
Wright-Patterson AFB OH 45433

AF SBIR/STTR Program Manager: Augustine Vu
AF CPP Program Manager: Richard Flake
Website: www.sbirsttrmall.com
Comm: (800) 222-0336
Fax: (937) 255-2219
e-mail: afrl.xppn.dl.sbir.hq@wpafb.af.mil

