



Research & Technology

Today's Systems Engineering Challenges

Mark Burgess
Chief Engineer, Engineering, Operations & Technology
The Boeing Company

The SERC and Boeing

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- **Boeing became the first corporate partner of the SERC program in 2012**
- **Led by Chief Engineering Mark Burgess**
- **Boeing's SERC Steering Team**
 - **Marc Nance – Enterprise Domain Leader for Systems / Software Engineering**
 - **Gary Motchan – BDS Function Director, Systems Engineering, Software Engineering**
 - **Kevin Leath – BCA Systems Engineering**
 - **Bob Scheurer – BDS Systems Engineering Leader**
 - **Kareem Mohammad – BCA Systems Engineering Leader**
 - **Christi Gau Pagnanelli – BDS Systems Engineering Leader**

Systems Engineering Research Center Announces Doctoral Fellows Program, with The Boeing Company as the First Partner



Stevens, NJ. The Systems Engineering Research Center (SERC) announces the formation of the SERC Doctoral Fellows Program to facilitate research development and research rotation opportunities with practitioners in US industry, Federally Funded Research and Development Centers (FFRDCs), national laboratories, and government. Through the Doctoral Fellows Program, the SERC harnesses the collective energy of 200 researchers and over 300 collaborator researchers across the US to provide a unique opportunity for future systems engineers to develop both the skills as well as one-on-one relationships with thought leaders who serve as mentors during the Doctoral process. The Boeing Company is the first industry participant in the program.

The SERC Doctoral Fellows Program addresses an important element of the SERC's mission to build tomorrow's community through research and education," said Dr. Dinesh Verma, Executive Director of the SERC and Dean of the School of Systems and Enterprises at Stevens Institute of Technology. "We are excited to have The Boeing Company join us as the first participant to link the SERC collaborator with employees who are interested in pursuing research related to complex systems issues."

The program aims to expand systems research opportunities by cultivating an environment that is mutually beneficial to government, industry, and academia. Participating organizations will select employees to become doctoral students with a focus on systems-related research that is in alignment with the SERC's vision. Organizations implement this commitment through their normal internal tuition reimbursement programs and agreement with their PhD release time allowing the employees to dedicate time to the doctoral studies and research in close collaboration with SERC collaborator university faculty members.

The increasing complexity of aerospace systems demands transforming systems engineering practice throughout the nation," said Mark Burgess, Chief Engineer, Boeing Research & Technology. "The Boeing Company is proud to join the SERC Doctoral Fellows Program to facilitate collaboration in system-related research."

As the first industry participant, Boeing will initially sponsor up to five SERC doctoral fellows for a minimum of three years each. The number of sponsored fellows depends on the size of the participating organization, which is limited to US-based organizations only. As the program matures and gains momentum, the pool of doctoral students is expected to increase in number.

The SERC Doctoral Fellows program extends this dynamic network of systems engineering thought leaders," said Dr. Kristen Baldwin, Principal Study in the Office of the Deputy Assistant Secretary of Defense for Systems Engineering. "In turn, the SERC researchers obtain insight into current problems and state of practice, informing research in areas of critical importance to the DoD and the nation. The Fellows program contributes to the SERC vision to become the networked national resource to further systems research."

Boeing's 1st SERC Fellow

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William Harkness

- Enterprise Technology Domain Engineer
- Engineering Operation & Technology

Supports: Enterprise Domain Leader for Systems Engineering, Marc Nance

Sponsored by: Dr. Mithra Sankrithi, Advanced Concepts Chief Engineer, Boeing Commercial Airplanes

SYSTEMS ENGINEERING Research Center

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News

1/7/2013

Boeing names first fellow to new Systems Engineering research collaborative

Boeing engineer Bill Harkness will be aligning his upcoming dissertation with the Systems Engineering Research Center to enhance research collaboration at the Commercial Airplanes Product Development group.

The Systems Engineering Research Center, or SERC, is a doctoral program that works collaboratively with 23 universities and more than 300 researchers across the United States. It enables doctoral systems engineers to develop their abilities, establish working relationships with mentors and conduct research in an environment that is beneficial to government, industry and academia.

Boeing was the first company to become a SERC industry partner last year. Recently, Harkness was named as the company's first fellow for the program.


Harkness, an enterprise domain engineer for Boeing's Enterprise Technology Strategy, is nearing completion of his doctoral coursework in systems engineering at the Missouri University of Science and Technology (formerly known as University of Missouri, Rolla). He is beginning his dissertation research, work that could provide Boeing with potential avenues to break the cost curve and enhance innovation practice.

"I am extremely fortunate to be given the opportunity to enrich Boeing through my research and would love to see this practice continue with other employees," Harkness said. "Boeing contributes so much towards the education of its workforce – our work should contribute back in a way that makes the company better as a whole."

Because Harkness works for Engineering, Operations & Technology and his research will support Commercial Airplanes Product Development's Advanced Concepts and Product Evaluation organization, his work is a truly a "One Boeing success story," said Marc Nance, enterprise domain leader for the Systems/Software Engineering & Analysis domain.

"When you look 20 or more years ahead at future products, many are neglected or dismissed due to a variety of factors," Nance said. "Bill's research on combining product development with computational intelligence will be used to promote the innovative practice at Boeing."

"Participating in the SERC framework allows Boeing to access other innovative thinkers and companies who are trying to improve the product development model, as well as contribute back per our doctoral fellow sponsorship," Nance added.



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Boeing's 2nd SERC Fellow


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Julie Peirson

- 737 MAX Product Development Chief Engineer
- Boeing Commercial Airplanes

Supports: Small Airplane Product Development,

Sponsored by: Mark Burgess and Greg Hyslop (VP of Boeing Research and Technology)



SYSTEMS ENGINEERING
Research Center **Julie Peirson named second Boeing SERC Fellow**

Julie Peirson, currently the Commercial Airplanes 737 MAX Product Development chief engineer, has been named the second Boeing SERC Fellow (Systems Engineering Research Center).

This is a significant accomplishment - the Systems Engineering Research Center (SERC) is a doctoral program that works collaboratively with 23 universities and more than 300 researchers across the United States. It enables doctoral systems engineers to develop their abilities, establish working relationships with mentors and conduct research in an environment that is beneficial to government, industry and academia.

Boeing was the first... year.

Participating in the... innovative thinkers
and companies v... fel, as well as
contribute back p...



Boeing's 3rd SERC Fellow

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Josh Goldschmid

- **Seat Integration project Engineer**
- **Boeing Commercial Airplanes**
- **The Boeing Company**

Supports: Seats program across all models of Boeing Commercial Airplanes

Sponsored by: Kevin Leath, Director of Affordability and Boeing Product Development System (BPDS)





1947

1957

1967

1977

Engineering Products





Boeing Major Business Units

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Engineering Operations & Technology (EO&T)

Boeing
Research & Technology

Boeing
Test & Evaluation

Boeing
Information Technology

Boeing Commercial Airplanes

- Headquartered in the Puget Sound region of Washington state
- 2012 revenues of \$49.1 billion
- Approximately 66,000 employees
- Offering a family of airplanes and a broad portfolio of aviation services for passenger and cargo carriers worldwide
- Represent three quarters of the world's fleet, nearly 12,000 jetliners in service
- 70 percent of Boeing commercial airplane sales outside of the United States
- Includes Commercial Avionics Services (CAS)

- Environment, Health and Safety
- Intellectual Property Management
- Enterprise Functional Excellence

~ 18,000 Personnel
World Wide

Boeing Defense, Space & Security

- Headquartered in St. Louis, Mo., with global operations in 4 nations and 21 states
- 2012 revenues of \$32.6 billion
- Approximately 66,000 employees
- Balanced backlog across all markets including a strong mix of development, production and support contracts
- Integrating defense, space, intelligence, and communications capability

Why this is important to us

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Complexity Integration: Boeing Global

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**\$27B in purchases annually (includes engines)
1,200 production suppliers in 4,500 factories
employing approximately 500,000 people**

- **737 contains < 500K parts**
- **747 contains approximately 6M parts**
- **>750M components & assemblies purchased each year**
- **Growing to over a billion* in 2014**

* Boeing Commercial Airplane only



**Supplier parts and assemblies
make up 60% of product cost**

High volume, complex business model

Product Development Evolution

(Increasing level of business model complexity)



Boeing 787

- 464,000 lbs
- 64,000 lbf
- Composite/aluminum/Ti
- 10^6 parts

Northrop : El Segundo



1983

McDonnell Douglas – St. Louis

- 36,000 lbs
- 32,000 horsepower
- Aluminum/titanium
- 10^5 parts



1916

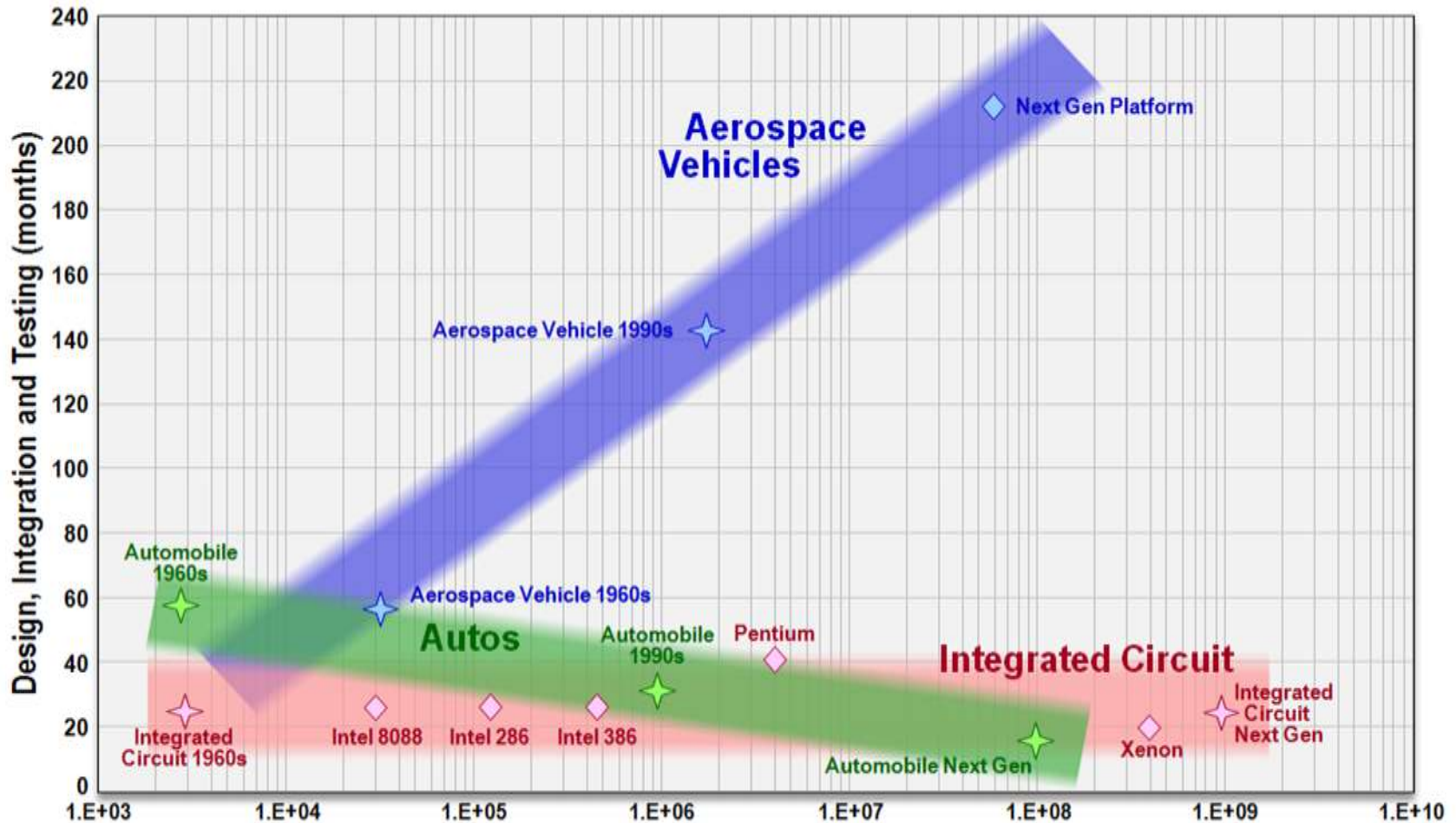
- 2,800 lbs
- 125 horsepower
- Wood and canvas
- 10^3 parts



Partnering / Integration Complexity

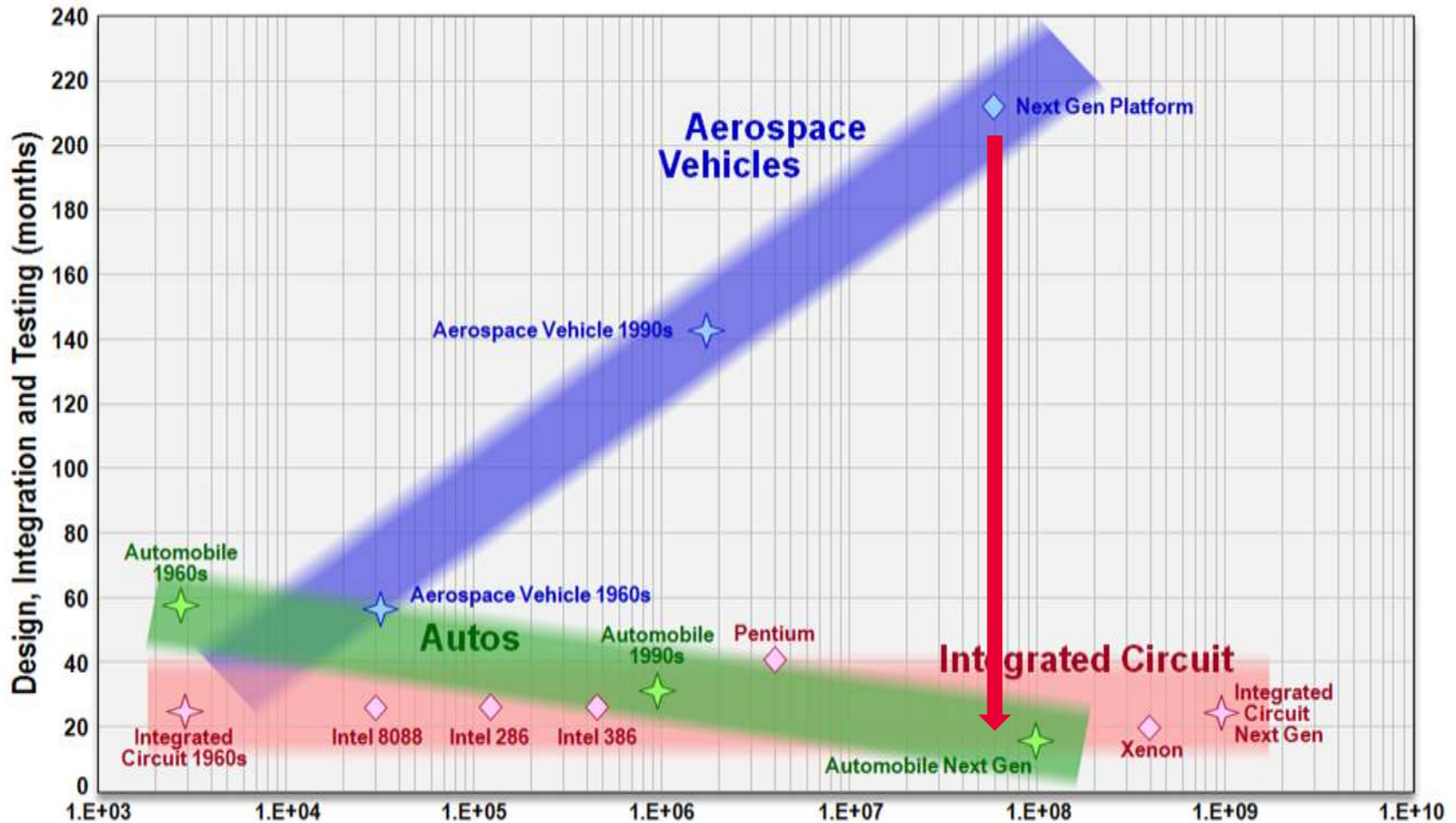
Aerospace Product Development

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Hopes we have for the future: Why SERC is important to us

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Mark's Assertions

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- **Systems Engineering is paramount in improving the competitiveness of aerospace & defense**
- **The SERC offers the latest efforts to revolutionize SE**
- **Boeing recognizes the importance of the SERC and continues to support the effort**

Closing Thoughts

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“We are embarked as pioneers upon a new science and industry in which our problems are so new and unusual that it behooves no one to dismiss any novel idea with the statement that ‘it can’t be done!’”

– *William E. Boeing, founder, The Boeing Company*



