

# ***Robert G. Pettit IV, Ph.D.***

*Senior Project Leader*

*Software Systems Engineering Department*

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## **Summary**

Rob Pettit has over 30 years of experience in the software engineering industry with expertise in large-scale, mission-critical software systems. Dr. Pettit is internationally recognized in the fields of model-based software engineering; real-time software systems; and in the Ada programming language. He has authored over 35 refereed papers and co-authored the textbook globally referenced as the Ada coding standard. Currently, Dr. Pettit is the senior project leader for The Aerospace Corporation's Software Systems Engineering Department. In this role, Dr. Pettit is responsible for mission assurance activities related to spaceflight software; mentoring junior staff; and supporting corporate interests in model-based software engineering.

Dr. Pettit has taught numerous industrial and academic courses on software architecture, modeling, design, development, and analysis. Dr. Pettit is very active in the professional community, having been elevated to Senior Member in the IEEE; serving as program and general chair for multiple international conferences; and delivering presentations at international forums. Dr. Pettit is an Adjunct Professor at both George Mason University and Virginia Tech, where he teaches courses in software architecture design and modeling. Dr. Pettit received his B.S., Computer Science / Mathematics degree in 1991 from the University of Evansville, his M.S., Software Systems Engineering degree in 1995 from the George Mason University, and his Ph.D. in Information Technology Engineering / Software Engineering from George Mason University in 2003. Dr. Pettit is also very passionate about STEM education for the next generation and regularly volunteers in the Loudoun County Public Schools to assist in computer science and aerospace education at the high school level.

## **Experience**

**The Aerospace Corporation, Chantilly, Virginia (1999 to Present)**

**Software Systems Engineering Department**

**Information Systems and Cyber Division, Engineering and Technology Group (ETG)**

***Sr. Project Leader***

- Developed and successfully launched Aero-HAB1 balloon as a flight-software proof of concept platform
  - Captured eclipse shadow progression from altitude of 30km
  - Used as basis for future intern projects and low-cost FSW experimentation platform
- Lead corporate efforts to advance support of space flight software mission assurance activities
  - Broker flight software support between ETG and program offices
  - Collaborated with FSW team to develop corporate flight software improvement roadmap
  - Lead or assisted in the organization of flight software conference events including the Aerospace Flight Software Workshop; NRO Lessons Learned Forum; Aerospace Testing Seminar; and the NASA/JHU Flight Software Workshop
- Principal investigator for over \$3M of independent corporate research projects. Topics have included:
  - Mission assurance for flight software and embedded systems (Corporate Research Initiative)
  - Model-based software engineering for mission critical software, embedded software, and spaceflight systems
  - Effective performance modeling and analysis for UML software designs
- Independent assessments of Ada flight code
  - Co-authored coding standard ("Ada Quality and Style") adopted by most contractors
- Mentoring and oversight of software design and development efforts
- Developed and taught courses for The Aerospace Institute
- Advisor for NRO DII, NRO MERIT, and NASA ESTO research proposals
- **Awards:**
  - Mentored project that ultimately received U.S. Government's Top 5 Quality Software Projects Award
  - Team Achievement Award for Flight Software Improvement Initiative
  - Directorate L Program Recognition Award
  - Individual Achievement Award for support to EXPERT development effort
  - Aerospace Institute Award for "Inspecting Object-Oriented Work Products using the UML" course
  - Team Achievement Award for support to Flight Software Workshop
  - Multiple SPOT awards

### **Software Productivity Consortium, Herndon, VA (1995-1999)**

#### ***Team Lead, Software Modeling and Design***

- Managed Consortium's product line on software modeling and design
- Authored Consortium's UML-based software engineering methodology
- Provided object-oriented mentoring to Consortium member companies
- Co-author for internationally recognized "Ada 95 Quality and Style", used as the government and industry standard for Ada programming practices
- Researched and developed processes, methods, and analysis techniques for the design, and implementation of software systems.
- Developed written guidelines and training courses to support the users of Consortium software processes, methods, and analysis techniques.
- Provided consulting and training in software engineering methodologies
- Evaluated and selected tools and environments to automate the defined software development processes and methods.

### **Sallie Mae, Herndon, VA (1994 – 1995)**

#### ***Software Architect, Office of the CIO***

- Designed and implemented corporate software development standards.
- Provided technical advice for the corporate software process improvement initiative and for corporate software development methods.
- Provided consulting services for client/server development projects.
- Mentored object-oriented development efforts.
- Analyzed and recommended software development tools and environments.

### **E-Systems, Melpar Division, Falls Church, VA (1991-1994 )**

#### ***Software Analyst***

- Designed and developed software for remotely controlled real-time intelligence systems.
- Lead software engineer for a real-time signal processing subsystem.
- Supported field site-test and installation activities for mission-critical software.
- Led object-oriented migration efforts for initial pilot subsystem.
- Applied structured and object-oriented software development paradigms within the context of DOD-STD-2167A processes.
- Received award for support to military operations

### **Naval Weapons Support Center, Crane, IN (1989-1991)**

#### ***Computer Scientist***

- Designed and developed real-time simulations and graphical interfaces for Marine Corps missile systems.
- Evaluated simulation platforms and development tools.
- Consulted with armed-forces agencies regarding the development of real-time combat simulations.

### **Bristol-Myers, Evansville, IN (1987-1989)**

#### ***Systems Programmer***

- Developed FDA-certified real-time automation system for pharmaceutical production processes.
- Responsible for software design, development, testing, and maintenance.

## **Education**

### **Doctor of Philosophy in Information Technology (Software Engineering)**

George Mason University, Fairfax, Virginia, May 2003

### **Master of Science in Software Systems Engineering**

George Mason University, Fairfax, Virginia, January, 1995

### **Bachelor of Science in Computer Science / Mathematics**

University of Evansville, Evansville, Indiana, May, 1991

## **Teaching Experience**

### **George Mason University, Computer Science Department**

- Software Modeling and Architecture Design (SWE 321 & 621)
  - Model-based software engineering, primarily for real-time and concurrent systems
- Software Architecture (SWE 443)
  - Architecture modeling and quality attributes
- Real-Time and Embedded Software Project Lab (SWE 626)
  - Introduced hands-on embedded software systems curriculum through Lego Mindstorms

### **Virginia Polytechnic and State University (Virginia Tech), Computer Science Department**

- Software Design (CS 5744)
  - Developed and taught software design/modeling curriculum
- Software Engineering (CS5704)
- Concurrent and Real-Time Programming in Java (CS5944)
  - Real-time embedded programming using Lego Mindstorms

### **Design and Development of Real-Time Embedded Software Using Ada 2005 and UML**

- Ada Europe 2009 Conference Tutorial
- SIGAda 2010 Conference Tutorial

### **Establishing Review Criteria for UML Work Products**

- UML 2002 Conference Tutorial

### **Inspecting Object-Oriented Work Products Using the Unified Modeling Language**

- The Aerospace Institute

### **Ada-based Design Approach for Real-Time Systems (ADARTS)**

- Software Productivity Consortium
- TRI-Ada '96 Conference Tutorial

## **Professional Activities**

### **Senior Member, Institute of Electrical and Electronics Engineers (IEEE)**

- Elected to senior member status in February, 2006

### **International Journal of Software and Systems Modeling (SoSyM)**

- Editorial board

### **IEEE International Symposium for Object-oriented Real-time Computing (ISORC)**

- 2013-Present – Steering Committee Co-Chair
- 2007, 2008, and 2014 – General Co-Chair for The Americas
- 2009 and 2011 – Workshop Chair
- 2005-2006 – Program Committee Co-chair / Chair, Industrial Advances Track
- 2004 – Program Committee Member

### **ACM/IEEE International Conference on Model Driven Engineering Languages and Systems (MODELS)**

- 2009-Present – Steering Committee
- 2009 – General Chair
- 2006 – Chair, Doctoral Symposium
- 2006-2008, 2010 – MODELS Program Committee Member
- 2005 – Program Committee Member, MARTES workshop
- 2004 – Program Committee Member, SVERTS workshop

### **International Conference on Model-Driven Engineering and Software Development**

- 2013-Present – Program Committee Member

### **IFIP Workshop on Software Technologies for Embedded and Ubiquitous Computing Systems (SEUS)**

- 2010 – Program Co-Chair
- 2006-2009 – Program Committee Member

### **ACM SigAda**

- 2010-2011 – Tutorial Chair

## **Publications**

“On the Feasibility of Automatically Detecting and Recovering from SEUs in Cyber-physical Space Systems”, Robert G. Pettit and Aedan D. Pettit, *Proc. 4th International Workshop on Software Engineering for Smart Cyber-Physical Systems, 40th International Conference on Software Engineering (ICSE 2018)*, Gothenburg, Sweden, May 2018.

“Detecting Single Event Upsets in Embedded Software”, Robert G. Pettit and Aedan D. Pettit, *Proc. 21st International Symposium on Real-time Computing (ISORC 2018)*, Singapore, May 2018.

“A Model-Based Approach for Integrating Executable Architectural Design Patterns in Space Flight Software Product Lines,” Julie S. Fant, Hassan Gomaa and Robert G. Pettit, in *Software Technologies*, Springer 2016.

“Integrating and Applying Architectural Design Patterns in Space Flight Software Product Lines,” Julie S. Fant, Hassan Gomaa and Robert G. Pettit, *Proc. 10th International Joint Conference on Software Technologies (ICSOFT 2015)*, Colmar, France, July 2015.

“On the Needs and Challenges of Model-Based Engineering for Spaceflight Software Systems,” Robert G. Pettit IV, Navneet Mezciani, and Julie S. Fant *Proc. 17th International Symposium on Real-time Computing (ISORC 2014)*, 2014, Reno, NV USA, June 2014.

“Highlighting the Challenges of Model-Based Engineering for Spaceflight Software Systems,” Robert G. Pettit IV and Navneet Mezciani *Proc. 5th International Workshop on Modeling in Software Engineering (MiSE 2013)*, 2013, San Francisco, CA, USA, May 2013.

“A Pattern-based Modeling Approach for Software Product Line Engineering,” Julie S. Fant, Hassan Gomaa, and Robert G. Pettit IV, *Proc. 46th Hawaii International Conference on Systems Sciences (HICSS 2013)*, Maui, Hawaii, USA, January 2013.

“A Comparison of Executable Model Based Approaches for Embedded Systems,” Julie S. Fant, Hassan Gomaa, and Robert G. Pettit IV, *Proc. 2nd International Workshop on Software Engineering for Embedded Systems (SEES 2012)*, Zurich, Switzerland, June 2012.

“Software Product Line Engineering for Spaceflight Software,” Julie S. Fant, Hassan Gomaa, and Robert G. Pettit IV, *Proc. 3rd International Workshop on Product Line Approaches in Software Engineering (PLEASE 2012)*, Zurich, Switzerland, June 2012.

“Architectural Design Patterns for Flight Software,” Julie S. Fant, Hassan Gomaa, and Robert G. Pettit IV, *Proc. 10th IEEE International Symposium on Object-oriented Real-time distributed Computing (ISORC 2011)*, Newport Beach, California, USA, March 2011.

“Modeling and Prototyping of Real-Time Embedded Software Architectural Designs with Colored Petri Nets”, Robert G. Pettit IV, Hassan Gomaa, and Julie S. Fant, *Proc. 4th International Workshop on Model Based Architecting and Construction of Embedded Systems (ACES-MB) 2011*, Wellington, New Zealand, October 2011.

“Architectural Design Patterns for Flight Software”, Julie S. Fant, Robert G. Pettit IV, and Hassan Gomaa, *Proc., Workshop on Model-Based Engineering for Real-Time Embedded Systems (MoBE-RTES) 2011*, Newport Beach, CA, March 2011.

“Design and Development of Concurrent, Embedded, and Real-Time Software Using UML and Ada 2005”, Robert G. Pettit IV, *Tutorial Proc., SIGAda 2010*, Fairfax, Virginia, October 2010.

“Evaluating Concurrent Software Architectures using Petri Nets”, Robert G. Pettit IV, *Tutorial Proc., Petri Nets 2009*, Paris, France, June 2009.

“Modeling and Prototyping of Concurrent Software Architectural Designs with Colored Petri Nets”, *Proc. Petri Nets in Software Engineering*, Paris, France, June 2009.

“Designing Real-Time, Concurrent, and Embedded Software Systems using UML and Ada”, *Tutorial Proc. 14th International Conference on Reliable Software Technologies - Ada-Europe 2009*, Brest, France, June 2009.

“Towards Composable Timing for Real-Time Software”, Peter Puschner, Raimund Kirner, and Robert G. Pettit IV, *Proc. IFIP International Workshop on Software Technologies for Future Dependable and Distributed Systems*, Tokyo, Japan, March 2009.

“Increasing Confidence in Concurrent Software Through Architectural Analysis”, Robert G. Pettit IV, *Proc. 13th International Conference on Reliable Software Technologies - Ada-Europe 2008*, Venice, Italy, June 2008.

“Analyzing Behavior of Concurrent Software Designs for Embedded Systems”, Robert G. Pettit and Hassan Gomaa, *Proc. 10<sup>th</sup> IEEE International Symposium on Object-oriented Real-time distributed Computing (ISORC 2007)*, Santorini Island, Greece, May 2007.

“Independent Model-Driven Software Performance Assessments of UML Designs”, Julie A. Street, Robert G. Pettit, and Hassan Gomaa, *Proc. 10<sup>th</sup> IEEE International Symposium on Object-oriented Real-time distributed Computing (ISORC 2007)*, Santorini Island, Greece, May 2007.

“Modeling Behavioral Design Patterns of Concurrent Objects”, Robert G. Pettit IV and Hassan Gomaa, *Proc. 28<sup>th</sup> International Conference on Software Engineering (ICSE)*, Shanghai, China, May 2006.

“Lessons Learned Applying Performance Modeling and Analysis Techniques”, Julie A. Street and Robert G. Pettit IV, *Proc. 9<sup>th</sup> IEEE International Symposium on Object-oriented Real-time distributed Computing (ISORC 2006)*, Gyeongju, Korea, April 2006.

“The Impact of UML 2.0 on Existing UML 1.4 Models”, Julie A. Street and Robert G. Pettit IV, *Proc. 8<sup>th</sup> International Conference on Model Driven Engineering Languages and Systems (MoDELS)*, Montego Bay, Jamaica, October 2005.

“Lessons Learned Applying UML in the Design of Mission Critical Software”, Robert G. Pettit IV and Julie A. Street, *Proc. 7<sup>th</sup> International Conference on the Unified Modeling Language (UML)*, Lisbon, Portugal, October 2004.

“Modeling Behavioral Patterns of Concurrent Software Architectures Using Petri Nets,” Robert G. Pettit IV and Hassan Gomaa, *Working IEEE Conference on Software Architectures (WICSA) 2004*, Oslo, Norway, June 2004.

“Lessons Learned Applying UML in the Design of Embedded Software Systems,” Robert G. Pettit IV, Invited Paper, *Workshop on Software Technology for Future Embedded and Ubiquitous Systems (WSTFEUS) 2004*, Vienna, Austria, May 2004.

“Improving the Reliability of Concurrent Object-Oriented Software Designs,” Robert G. Pettit IV, *Workshop on Object-oriented Real-time and Dependable Systems (WORDS) 2003*, Capri, Italy, October 2003.

“Establishing Inspection Criteria for UML Models,” Robert G. Pettit IV, Tutorial *Proc. 5<sup>th</sup> International Conference on the Unified Modeling Language (UML)*, Dresden, Germany, October 2002.

“Improving the Reliability of Object-Oriented Architecture Designs: An Approach Using Colored Petri Nets,” Robert G. Pettit IV, *Symposium on Reliable Object-Oriented Programming*, London, England, October 2001.

“Modeling State-Dependent Objects using Colored Petri Nets,” Robert G. Pettit IV and Hassan Gomaa, *Coloured Petri Nets 2001: Modeling of Objects, Components and Agents Workshop*, Århus, Denmark, August 2001.

“Validation of Dynamic Behavior in UML Using Colored Petri Nets,” Robert G. Pettit IV and Hassan Gomaa, *UML 2000 Dynamic Behavior Workshop*, York, England, October, 2000.

“Modeling Object-Oriented Behavior Using Petri Nets,” Robert G. Pettit IV, *OOPSLA '99 Behavioral Semantics Workshop*, Denver, Colorado, November, 1999.

*Consortium Object-Oriented Software Engineering using UML (COSUML)*, Robert G. Pettit IV and Hassan Gomaa, Software Productivity Consortium, 1998.

*Ada 95 Quality and Style: Guidelines for Professional Programmers*, Christine Ausnit-Hood, Kent A. Johnson, Robert G. Pettit IV, and Steven B. Opdahl, Springer-Verlag, 1997.

"Ada 95 Quality and Style," Robert G. Pettit IV and Christine Ausnit-Hood, *Software Technology Conference Proceedings*, Salt Lake City, UT, April, 1997.

"Using Ada 95 for the Design of Distributed Real-Time Systems," Robert G. Pettit IV, *TRI-Ada '96 Conference Proceedings*, Philadelphia, PA, December, 1996.

"Integrating Petri Nets With Design Methods for Concurrent and Real-Time Systems," Robert G. Pettit IV and Hassan Gomaa, *IEEE Real-Time Applications Workshop*, October, 1996.

*Ada 95 Quality and Style: Guidelines for Professional Programmers*, SPC-94093-CMC, Christine Ausnit-Hood, Kent A. Johnson, Robert G. Pettit IV, and Steven B. Opdahl, Software Productivity Consortium, October, 1995.

“A Software Design Method for Ada 95 Based Concurrent and Real-Time Systems,” Robert G. Pettit IV and Hassan Gomaa, *TRI-Ada '95 Conference Proceedings*, Anaheim, CA, November, 1995

## **Invited Talks**

“Pains in Model-Based Engineering – Views from an IV&V Perspective”, Robert G. Pettit IV, *ACM/IEEE 21st International Conference on Model Driven Engineering Languages and Systems (MODELS 2018)*, Copenhagen, Denmark, October 2018.

“Model Based Engineering Challenges for the Spaceflight Software Domain,” Robert G. Pettit IV, Keynote Address to the *International Workshop on the Globalization of Modeling Languages (GeMOC 2013)*, Miami Beach, Florida, USA, October 2013.

“Flight Software Risk Mitigation Through Early Modeling and Analysis”, Robert G. Pettit IV and Alan Unell, *PMAG Symposium*, Los Angeles, California, February 2009.

“Model Based Design and Development of Real-Time Embedded Systems”, Presentation to Department of Computing, Lancaster University, England, January 2008.

“Modeling and Analysis for Real-Time Software Systems”, Presentation to Real-Time Systems Group, Technische Universität Wien, Vienna, Austria, October 2006.

“Careers in Mission-Critical Software Engineering”, Presentation to Student Chapter of ACM, University of Virginia, Charlottesville, Virginia, April 2006.

Panelist, *International Workshop on the Specification and Verification of UML Models for Real-Time and Embedded Systems (SVERTS) 2004*. Panel Topic: Applicability of UML for Real-Time Systems.

“Lessons Learned Applying UML in the Design of Embedded Software Systems,” *Workshop on Software Technology for Future Embedded and Ubiquitous Systems (WSTFEUS) 2004*, Vienna, Austria, May 2004.

## **Volunteer and Community Activities**

### **Microsoft Philanthropies / TEALS**

- Volunteer to assist high school computer science teachers

### **Loudoun County Public Schools**

- Judge for Regional Science and Engineering Fair (RSEF)
- STEM outreach for Aerospace Science courses

### **USA Track & Field**

- USATF Level 1 certified coach
- Discus and Shot Put coach for Woodgrove High School

### **Harmony United Methodist Church**

- Youth leader