

CHRISTOPHER B. WATKINS

AIAA Associate Fellow

SYSTEMS ARCHITECT - SYSTEMS ENGINEER - RESEARCH ENGINEER - PROGRAM MANAGER

Avionics / Platform Computing Systems / New Business Development / Engineering Management

Highly motivated Systems Architect with over 13 years of well-rounded engineering and management experience. Most recent work concentration is devoted to architecting aircraft avionics solutions for new business pursuits. Developed multi-national teams across the US, Europe and China. Experienced at working under pressure with demanding financial and time requirements. Program management experience with responsibilities focused on meeting program requirements, managing customer expectations, and developing long-term relationships built on trust. Areas of expertise include:

- Systems Engineering
- Electrical Engineering
- Optical Systems Engineering
- Aircraft Avionics
- New Business Development
- Program Management
- Civil Aircraft Certification (Level A)
- Remote Sensing / LIDAR

Architecting solutions that maximize business potential + customer satisfaction.
Developing global partnerships built on trust.

New Business Development:

Chris led a winning integrated avionics technical proposal for the COMAC C919 pursuit in China. He negotiated intellectual property contributions to development of a Chinese Joint Venture (JV) company. He managed large proposal teams of 100+ contributors and developed strong relationships with the customer and JV partner in China.

Systems Engineer / Architect:

Chris has developed a systems integration framework for a systems-of-systems architecture, and developed innovative civil aircraft certification strategies for the Boeing 787 Common Core System (CCS) avionics computing platform. Chris architects avionics systems for Business, Regional Transport Aircraft, and large Air Transport markets.

Research and Innovation:

Chris developed a new optical air data system technology for both military and commercial aircraft. He led the research, ground demonstration and directed a successful flight test that pressed the limits of the aircraft test bed and crew. Chris managed the research program by providing customer interface and leading research proposals.

Published Author / Industry Leadership:

Chris is a recognized industry expert in the field of Avionics Computing Systems and Integrated Modular Avionics (IMA). Chris is a published author in textbooks and industry conferences. Chris was Conference Chair and Technical Program Chair at the Digital Avionics Systems Conference (DASC).

WORK EXPERIENCE

GENERAL ELECTRIC (GE) AVIATION SYSTEMS - Grand Rapids, Michigan

May 2007 – Present

GE acquired Smiths Aerospace in May 2007

SYSTEMS ARCHITECT, AVIONICS SYSTEMS (May 2007 – present)

Systems Architect - New Business Development

- **Led winning new business proposals.** Led a winning pursuit and proposal in China as the technical lead of the COMAC C919 Integrated Avionics pursuit. Led other winning pursuits across Business Aviation, Regional Transport, and large Air Transport markets. Built strong customer relationships, re-calibrated GE Aviation's

understanding of customer requirements, managed engineering contributions to Requests for Information (RFI) and Requests for Proposal (RFP).

- **Developed platform computing architectures to support new business development.** Developed next generation architectures to meet needs of customers seeking quick, low-risk developments. Developed clean-slate, innovative architectures for customers seeking game-changing solutions. Experienced in Integrated Modular Avionics architectures, solutions for critical aircraft systems, and design for Level A safety & certification.
- **Enhanced GE Aviation Systems' reputation in industry.** Showcased company's leadership in industry by serving as Conference Chair and Technical Program Chair at Digital Avionics Systems Conference (DASC). Publish technical paper annually to promote company-related innovations in industry. Grew company participation at conferences through corporate sponsorships, establishing business leaders in plenary conference events, and motivating other employees to publish papers.

Systems Architect – Training Lead

- **Founded and led company-wide, global training program for GE Aviation Systems.** Developed & delivered biweekly training content, expert speakers, and online portal to recorded sessions. Established and led steering team to manage training program. Objective was to propagate “big-picture” understanding of product architectures and to elicit input from employees so we could leverage their experience in future developments. Grew the program to reach over 2/3 of the global engineering employee base annually.

Systems Engineering Lead – Common Core System (CCS) Certification

The CCS is an open-systems Integrated Modular Avionics (IMA) computing platform for the Boeing 787 Dreamliner. 787 avionics and electrical systems are hosted on CCS within an ARINC-653 partitioned operating environment that includes a shared computer processing system, communication channels (ARINC-664 Avionics Full Duplex [AFDX] Ethernet), and remote I/O modules. CCS is an innovative architecture and FAA certification program.

- **Led the Hosted Function Supplier certification support team.** Led team to develop innovative artifacts that support the certification efforts of *external* companies that host their systems on CCS. Developed an Impact Analysis process that significantly reduces costs associated with regression testing and hardware upgrades. Successfully outsourced work when internal team was short-staffed. Amidst strong pressure to start certification, successfully convinced Boeing that a premature start would drive unnecessary cost and schedule to both Boeing and GE.
- **Led the CCS software and configuration build & delivery team.** Developed an automated build and delivery solution for CCS software and configuration files that supports an FAA “Level A” certified system. Developed concept of operations, conceived top-level tool requirements and led implementation.

SMITHS AEROSPACE (SMITHS GROUP PLC) - Grand Rapids, Michigan

Nov 2004 – May 2007

BOEING 787 CCS SYSTEMS CERTIFICATION FOCAL (January 2006 – May 2007)

BOEING 787 CCS SYSTEMS ENGINEER (November 2004 – January 2006)

Systems Engineer - Common Core System (CCS) Project

- **Technical lead of CCS certification support for external companies.** Developed certification strategy for first-of-its-kind civil certification program (open-systems IMA program). Successfully obtained approval after presenting strategy to the FAA Seattle Aircraft Certification Office (SACO). This is most likely the first time that the new RTCA DO-297 “IMA Development Guidance and Certification Considerations” were applied to a certification program. Implemented strategy within Smiths Aerospace and administered program across all of the Boeing 787 hosted avionics supplier companies. Managed certification support team within Smiths Aerospace. Led development of certification artifacts including the plans, data sheets (DO-297 defined artifact), and analyses that justify differences/equivalence between test platforms and target platforms.
- **Led cross-functional certification team for the CCS platform.** Led team to address CCS platform certification issues and initiatives between functional areas (hardware, software, systems, and tools). Identified dependencies between the certification efforts for each functional group and facilitated communication channels to ensure a successful certification program.
- **Reduced complexity for a system-of-systems integration and certification effort.** Solved undefined dependencies with over 100 systems on the Boeing 787 airplane through an innovative contract-based approach to systems integration. Developed system of logic to support systems integration and a modular certification approach [of incremental acceptance] for the CCS. Applied concepts of compositional reasoning and change

containment (limited cost of change) to CCS safety and certification processes in order to substantiate a modular approach for the certification of integrated avionics components. Provided systems engineering interface to the Safety, Certification, and Test & Integration teams to ensure compliance with the requirements imposed by a modular certification process.

- **Led development of the CCS System Description Document that serves as central architectural reference internal to company and customer.** Achieved a common development vision for the CCS project by coordinating and communicating the CCS system architecture across the 300+ person team.
- **Developed verification plan for the CCS.** Responsible for ensuring verification plan compliance with commercial aviation industry certification guidelines: SAE ARP-4754, RTCA DO-178B, and RTCA DO-254.

MICHIGAN AEROSPACE CORPORATION - Ann Arbor, Michigan

Jan 1997 – Nov 2004

Founding employee. Member of original team who formed Michigan Aerospace in 1997, a 26-person company with \$2.7M of revenues in 2003, and over \$4M projected for 2004 when I departed.

PROGRAM MANAGER (November 2000 – November 2004)

RESEARCH ENGINEER (January 1997 – November 2000)

Program Manager – Molecular Optical Air Data System (MOADS)

The Molecular Optical Air Data System (MOADS) is an avionics package responsible for collecting air data products (airspeed, air density, temperature, angle of attack/side slip + others) for the aircraft flight data computers (pitot-static system replacement). The technology is a direct-detection, Light Detection And Ranging (LIDAR) system utilizing a 266nm UV laser. Applications include high performance tactile aircraft and unmanned [combat] aircraft systems (UAV/UAS and UCAV).

- **Managed development of the Molecular Optical Air Data System (MOADS).** Managed internal design team and interfaced with the customer to maintain/build relationship and manage expectations. Transformed initial customer skepticism into a relationship of trust and company confidence. Managed development cycle from conceptual design through the build and test stages.
- **Flight test director: prototype avionics system flight tests.** Successfully demonstrated instrument onboard a Beechcraft King Air 300 aircraft. Managed aircraft integration, flight readiness reviews and in-flight operations. Designed flight test plan, monitored instrument health and operated instrument. Non-pilot mission crewmember.
- **Managed development of the Reusable Launch Vehicle Air Data System (RLVADS),** a MOADS variant designed for an Air Force reusable space vehicle concept. Instrument designed to extend the range of the reentry glide profile. Completed a feasibility study and conceptual design.
- **Expanded the company's business base through business development activities.** Drafted proposals for numerous opportunities and won contracts with NASA, Navy, Air Force, and commercial customers. Contracts included Small Business Innovation Research (SBIR) programs, NASA Advanced Component Technology Programs (ACT) and commercial contracts.
- **Strengthened the company's intellectual property base.** Worked closely with a patent attorney to author, edit and submit provisional patents as well as full patent applications. Initiated relationship with IP lawyer to safeguard company's intellectual property (IP). Led negotiations of contract terms and conditions, while maintaining compliance with the [Defense] Federal Acquisition Regulations (FARS and DFARS).
- **Utilized standard project management processes and tools:** Earned Value Management System, Microsoft project scheduling, probability and impact risk assessment matrices, Failure Mode and Effect Analysis (FMEA), system requirements review (SRR), primary design review (PDR), critical design reviews (CDR), monthly interim reporting and budget reviews. Developed custom program management tools including embedded costing controls for Microsoft Project, electronic timesheet software with advanced reporting, property management database and inventory system, as well as custom Earned Value Accounting tools for Microsoft Excel.

Research Engineer – LIDAR Remote Sensing Systems

- **Developed control and analysis software for MOADS.** Developed Windows-based instrument control software, written in C and C++. Developed data analysis routines using the Interactive Data Language (IDL).
- **Completed MOADS wind tunnel testing.** Validated the instrument's operation and performance by measuring airflow velocity and air density inside of a wind tunnel. Compared results to pitot static system mounted in the wind tunnel.
- **Developed control software for GroundWinds,** a weather station that measures atmospheric wind profiles from 0-20km above ground level (www.groundwinds.com). Instrument is a direct-detection light detection and

ranging (LIDAR) system utilizing 532nm and 355nm laser systems. Worked with team to build instruments in New Hampshire at the base of Mount Washington and in Hawaii on Mauna Loa.

- **Designed and built an active control system for a Fabry-Perot etalon (optomechanical system).** Developed a first-generation computer-controlled Fabry-Perot interferometer consisting of two flat, reflective quartz plates separated by three piezo-electric motors. Responsible for firmware design and build of a software-based PID control system that was powered by a PIC microcontroller. Built controller from ground-up to actively control piezo motors to maintain specified etalon gap and plate parallelism.
- **Designed active control system for spacecraft laser steering mechanism.** Designed for WeatherSat concept, a satellite-based LIDAR instrument to measure atmospheric wind profiles. Responsible for piezo-electric motor-driven laser mirror system design and proof of concept laboratory demonstration.

ANN ARBOR AVIATION CENTER - Ann Arbor, Michigan

May 2002 – Sept 2008

CONSULTANT

- **Developed a computerized aircraft reservation system.** Developed a software tool implemented in PHP that allows pilots to reserve aircraft using a web interface rather than traditional paper-and-pencil bookkeeping. Invented and co-developed a user-account driven, rights-managed, Internet-accessible, self-help reservation system with built-in system backup and an automated installer. Software package entitled "Online Resource Scheduler (ORS)", distributed under the GNU General Public License (GPL). <http://ors.sourceforge.net>

ADVANCED MODULAR POWER SYSTEMS (AMPS) - Ann Arbor, Michigan

Feb 1996 - April 1998

ENGINEERING TECHNICIAN

- **Supported space-flight qualification tests for AMTEC/AWCS space shuttle flight-experiment.** Space-flight qualification tests included vibration testing, thermal testing and functional testing. Experiment installed in a Get-Away-Special canister (GAS Can). The Automated Wafer Cartridge System (AWCS) provided a proof of concept demonstration of an orbiting silicon / gallium arsenide crystal factory (for the manufacture of high quality integrated circuits). The Advanced Metal to Energy Conversion (AMTEC) technology, considered by NASA as a possible power source for deep space probes, is a sodium recirculation system. AMTEC is an alternative energy source that converts thermal energy to electric energy.
- **Trained as an operator of the AMTEC/AWCS space-flight experiment from the mission control operations center.** The mission's Payload Operations Control Center (POCC) was located at the NASA Goddard Space Flight Center. Mission operator responsibilities included: controlling system power-up & shut-down, operational monitoring, data collection and emergency procedures.

ENVIRONMENTAL RESEARCH INSTITUTE OF MICHIGAN (ERIM) - Ann Arbor, Michigan

Jan 1996 - July 1997

Now part of General Dynamics Corporation

ENGINEERING TECHNICIAN

- **Supported component testing for robotic space shuttle payload (AWCS).** Worked in the Space Automation & Robotics Center (SpARC) to complete functional testing of the electronic components used in the Automated Wafer Cartridge System (AWCS) space shuttle flight-experiment hardware. AMPS and ERIM had teamed together to share a space shuttle Get-Away-Special (GAS Can).
- **Developed a thermal control system to regulate electronics package in Antarctica climates.** Instrument designed and built to communicate with a group of orbiting satellites in order to provide calibration services. Responsible for build and test of the thermal control circuit used to manage electronics package in extremely cold environments.

DIMANGO PRODUCTS CORP. - Brighton, Michigan

June 1994 - Dec 1995

ENGINEERING TECHNICIAN

- **Characterized radiation pattern of radio transmitters.** Tested prototype radio transmitters for household remote control applications (ceiling fans, light switches and wireless door bells).
- **Assembled and tested electronic circuits.** Designed / etched circuit board layouts with Protel software.

PUBLICATIONS

- Understanding the Implementation of System Architectures in the Context of Distributed Cognition, Christopher B Watkins, Cihan H Dagli, 20th International Council on Systems Engineering (INCOSE), Chicago, Illinois, July 2010, http://www.watkinsplace.com/publications/System_Architectures_Distributed_Cognition_INCOSE2010-Watkins.pdf
- Comparing Two Industry Game Changers: Integrated Modular Avionics and the iPhone, Christopher B. Watkins, Randy Walter, 28th AIAA/IEEE Digital Avionics Systems Conference (DASC), Orlando, Florida, October 2009
- 2009 Year-in-Review: Digital Avionics, "Aerospace America" December 2009, Chris Watkins, Jim Rankin, AIAA Digital Avionics Technical Committee, Reston, VA, December 2009.
- 2008 Year-in-Review: Digital Avionics, "Aerospace America" December 2008: 48-49, Chris Watkins, Richard Katz, AIAA Digital Avionics Technical Committee, Reston, VA, December 2008.
- Design Considerations for Systems Hosted on Integrated Modular Avionics Platforms, Christopher B. Watkins, Randy Walter, 27th AIAA/IEEE Digital Avionics Systems Conference (DASC), St. Paul, Minnesota, October 2008
Awarded Best Session Paper
- Transitioning from Federated Avionics Architectures to Integrated Modular Avionics, Christopher B. Watkins, Randy Walter, 26th AIAA/IEEE Digital Avionics Systems Conference (DASC), Dallas, Texas, October 2007.
- Digital Avionics Handbook, Second Edition, chapter entitled "Genesis Platform", Chris Watkins, Randy Walter, Cary Spitzer (editor), CRC Press, Boca Raton, Florida, December 2006.
- Integrated Modular Avionics: Managing the Allocation of Shared Intersystem Resources, Christopher B. Watkins, 25th AIAA/IEEE Digital Avionics Systems Conference (DASC), Portland, Oregon, October 2006.
- Modular Verification: Testing a Subset of Integrated Modular Avionics in Isolation, Christopher B. Watkins, 25th AIAA/IEEE Digital Avionics Systems Conference (DASC), Portland, Oregon, October 2006.
- Molecular Optical Air Data System (MOADS) Prototype II, Christopher B. Watkins, Charles J. Richey, Peter Tchoryk, Jr., Greg A. Ritter, Michael Dehring, Paul B. Hays, Carl A. Nardell, Russell Urzi, International Optical Society (SPIE) Defense and Security Symposium, Orlando, Florida, April 2004.
- Molecular Optical Air Data System (MOADS) Flight Experiment, Christopher B. Watkins, Charles J. Richey, Peter Tchoryk, Jr., Greg A. Ritter, Paul B. Hays, Carl A. Nardell, Theodore C. Willis, Russell Urzi, International Optical Society (SPIE) AeroSense Conference, Orlando, Florida, April 2003.
- Molecular Optical Air Data System (MOADS), Christopher B Watkins, Peter Tchoryk, Jr., Scott Lindemann, Paul B. Hays, Carl A. Nardell. International Optical Society (SPIE) AeroSense Conference, Orlando, Florida, April 2001.

EDUCATION

M.S. Systems Engineering, 2012 (expected)

Missouri University of Science and Technology (formerly University of Missouri-Rolla), Rolla, Missouri

Systems Engineering Graduate Certificate, 2009, GPA: 4.00/4.00

Missouri University of Science and Technology (formerly University of Missouri-Rolla), Rolla, Missouri

B.S. Electrical Engineering, 1999

Kettering University (formerly GMI Engineering & Management Institute), Flint, Michigan

HONORS AND AWARDS

- 2009 GE Aviation Commercial Excellence Award
- AIAA Associate Fellow
- Leadership Forum, Smiths Aerospace
- Leadership Connections, Smiths Aerospace
- Best Session Paper, 27th Digital Avionics Systems Conference (DASC)

PROFESSIONAL AFFILIATIONS AND CERTIFICATIONS

- American Institute of Aeronautics and Astronautics (AIAA) Associate Fellow 2005-present
- AIAA Digital Avionics Technical Committee (DATC) 2007-present, served as: Publications Chair, Outreach Subcommittee Chair
- FAA licensed private pilot
- International Council on Systems Engineering (INCOSE) member 2008-present
- International Society for Optical Engineering (SPIE) member 2001-2005
- Aircraft Owners and Pilots Association (AOPA) member 2002-2009

TRAINING AND SPECIAL SKILLS

MANAGEMENT

- Building Essential Leadership Skills (GE)
- Proposal Development, Business Strategy
- Earned Value Management and Accounting
- Lean Six Sigma Green Belt Training (GE)

ENGINEERING

- System Safety and Architectural Design (University of Kansas)
- Risk Management for Leaders (GE Aviation)
- Persuasive Writing: Proposal Development (Smiths Aerospace)
- Requirements Management training (Compliance Automation, Ivy Hooks)
- Multi-level Security (MLS) Architecture Development & Certification training (Smiths Aerospace)

CIVIL AVIATION CERTIFICATION STANDARDS

- RTCA: DO-297, DO-178B Level A, DO-254
- SAE: ARP-4754

PROGRAMMING

- C/C++ (including MFC), Visual Basic, Pascal, Interactive Data Language (IDL), PHP, Perl, CGI, JAVA, Javascript, HTML, DHTML, Microsoft Windows Programming, Object Oriented Programming, Embedded Systems Programming

TOOLS & SOFTWARE

- DOORS requirements management software
- Dimensions change management
- Windchill ProjectLink project collaboration environment & document management system
- MathCAD, Matlab
- ZEMAX optical design software

CO-CURRICULAR ACTIVITIES

- General Aviation (Private Pilot)
- Amateur Radio Operator (Technician-Plus Class)
- Photography
- Small business owner & manager: Watkins Imaging (www.WatkinsImaging.com)