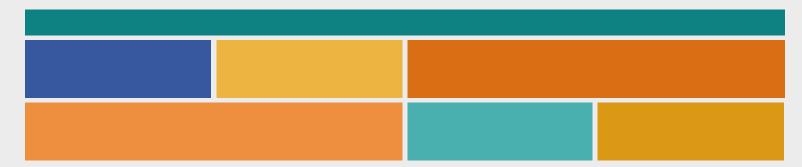
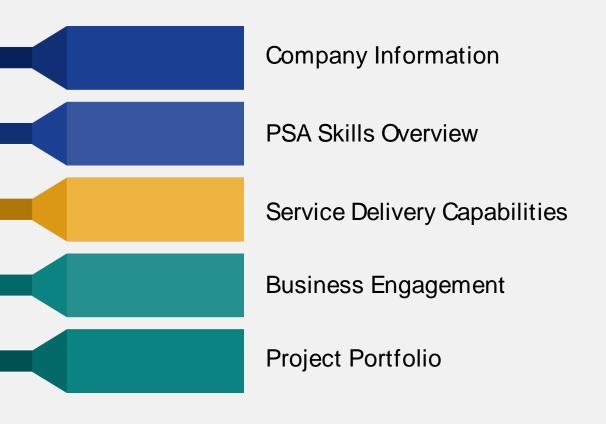


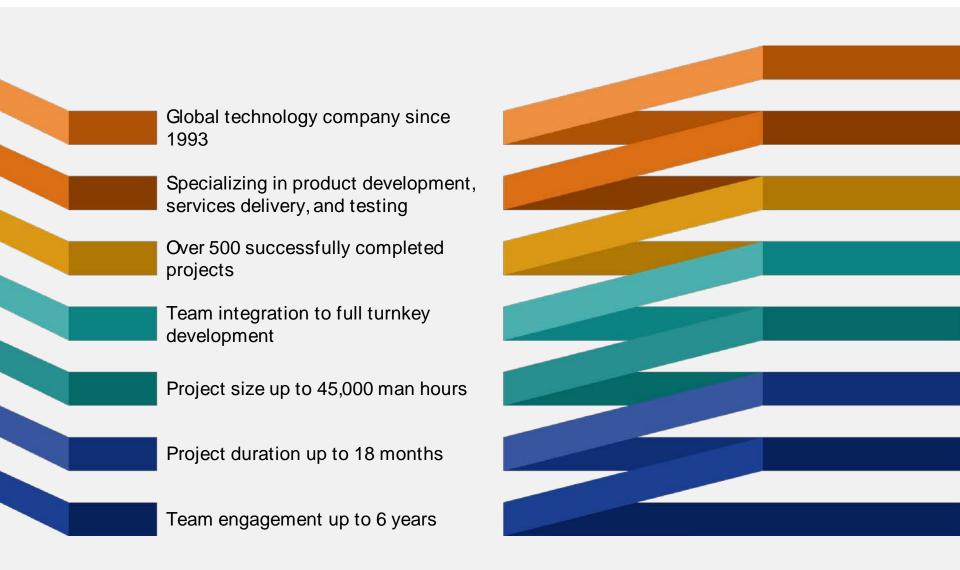
Project Delivery Capabilities

Professional Software Associates











Core Industry Expertise









Transportation

Semiconductors

Industrial



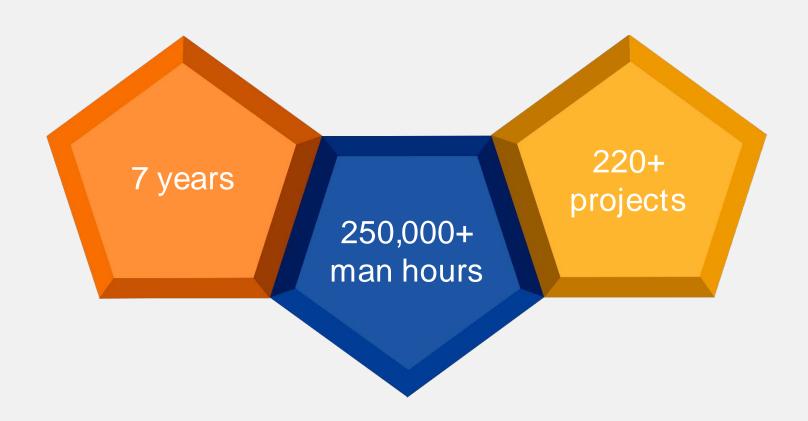




Medical

Consumer Devices

IT





Areas of Rail Experience



Dispatching

- Class I: UI, Authorities, Alarm, Bulletin, Data Exchange, Optimized Planning
- Metros: Deployed in North & South America, Europe, Asia

Interlocking Hardware

- Firmware: WIU (MicroLok), ITCM & ITCSM (Meteorcomm), Class D HA, web
- ♦ Tools: Compiler, Firmware updates, WIU Simulator, WIU Diagnostics, Test

Wayside

- Hardware: Track plans, Cabling plans, Circuit designs, BOM
- **Detailer**: CAD of Circuit designs, CAD Manufacturing details
- **Software**: Programming Guidelines, First station, Additional stations

Testing

- Vital Software: Engineering (source code), RAMS (Requirements)
- **FAT**: Test Case definition & execution for verification



Professional Software Associates, Inc.





























Hardware

- CPUs x86, PIC, ARM, FreeScale, FPGA
- Interfaces Optical, USB, Ethernet, CAN, PCI, (S)ATA, I2C, SPI, Serial, 1-Wire, Flash, ModBUS
- Signal Processing ADC/DAC, DSP, Audio, Video

Embedded Linux/RTOS

Customer Linux distributions, VxWorks, eCOS, SMX, ThreadX

Desktop/Server

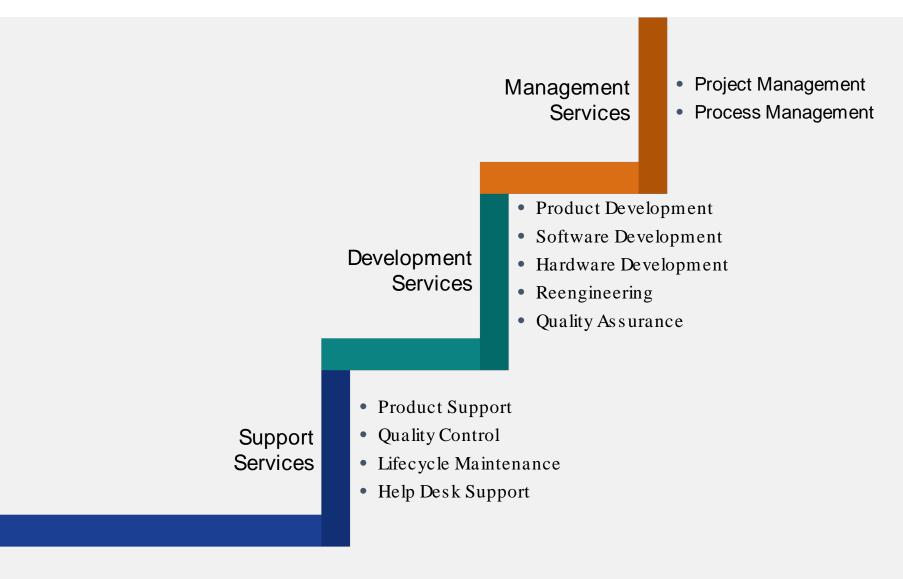
- Windows 2000, ME, 2003, 2008, XP, Vista, 7, 8, & 10
- Linux RHEL, CentOS
- Mac OS X

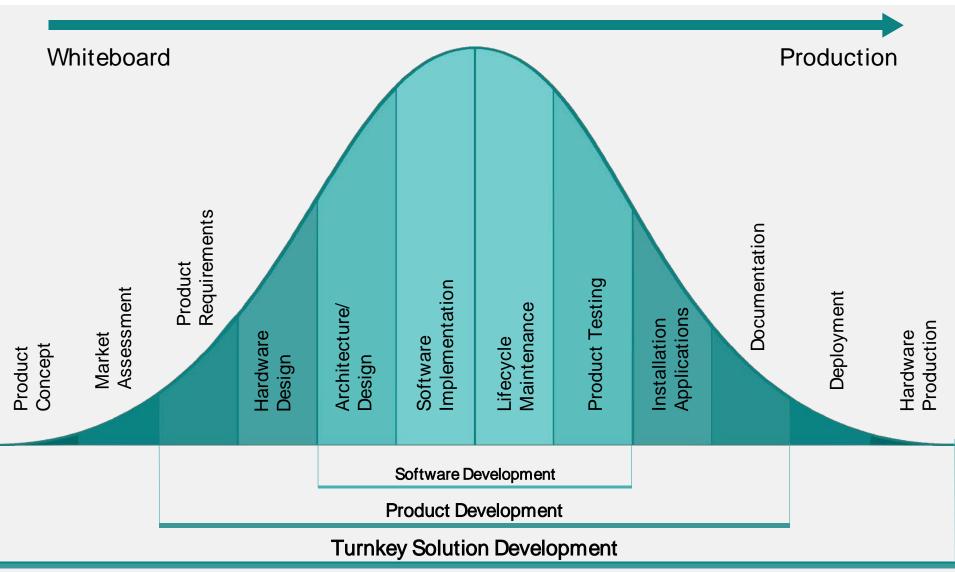
Mobile

- iOS
- Android
- Windows Mobile



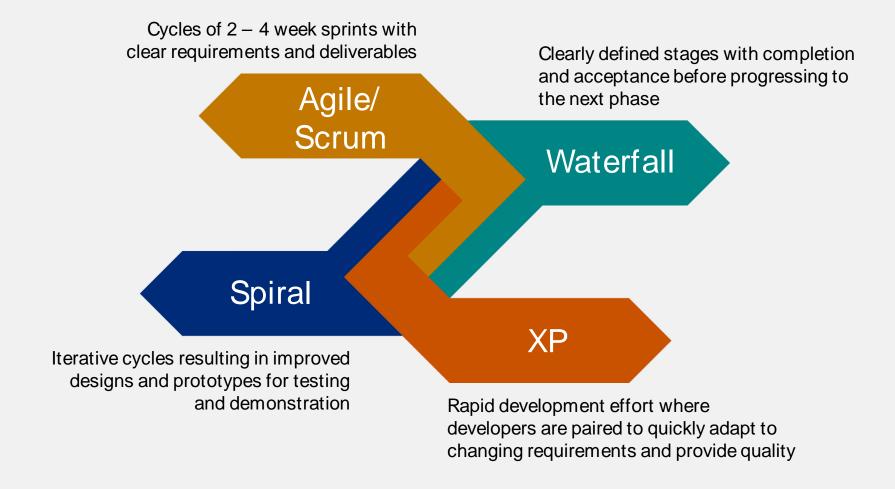


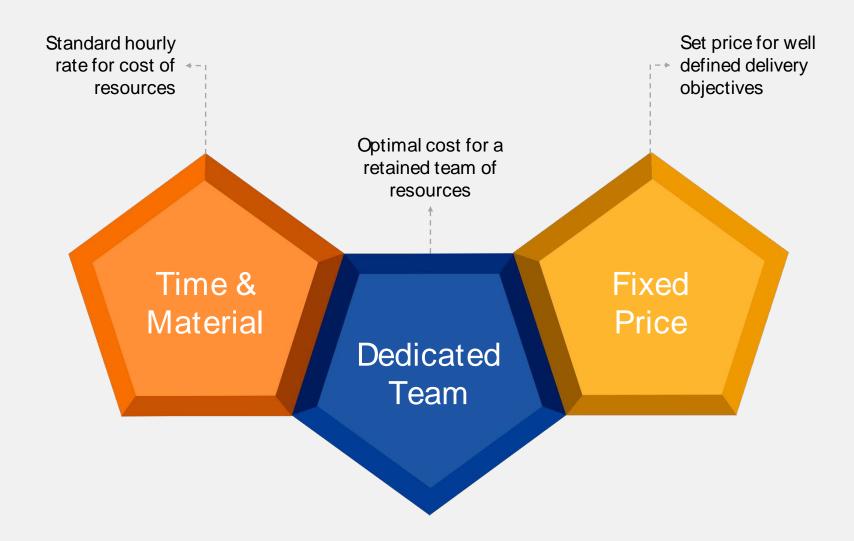






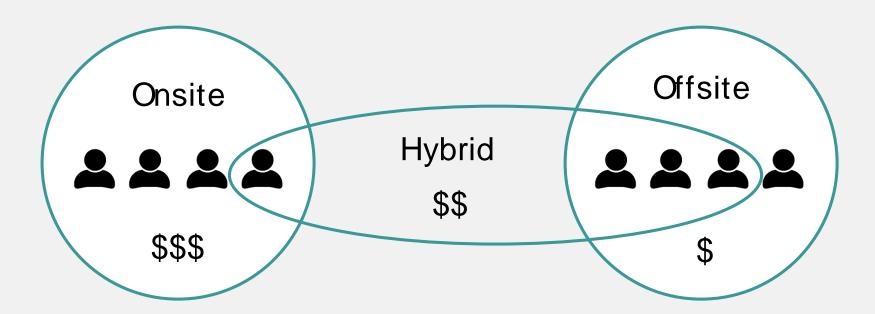








All delivery models follow project management standards and provide structured environment to facilitate effective communications and ensure service delivery



Microsoft Project Plans	Tasks	Resou	urces	Costs		
Communications	Weekly status	reports	Weekly status calls			
Project Tracking	Time Repor	ting	Timecards			
	Project		Actual hours			
	Plans Upda	ated	Remaining hours			
			Action Items			
	Project Tracking		Milestones			
	Templat		Budgets			
			Risks			
Bug Tracking System	Bug repor	ts	Feature requests			



Rail Projects of Interest







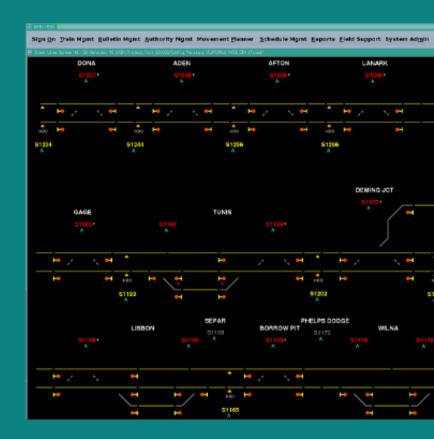
- Implementation of Positive Train Control for 37000 miles rail network
- Alarms, Signal Maintenance, Bulletin Management, Authorities
- Train Management, Security, System Simulation
- Optimized Train Planning

Technologies

- Linux
- C/C++
- Ot &X Windows
- Oracle

Tasks

- Detailed Design
- Software Implementation
- Unit Test Definition and Testing
- Functional Testing



Project Size

12 person project for 24 month duration; Subsystem Development



Internationalization of Railcar Maintenance App



S L City, UT 10/24/2014 07:18:47

@Trácks@ 2 @Fînd Cár@

 @Wörk Ordérs 4 PAdd Whééls@

5 @Cölléct Cörés

Scope of Work

- Internationalization of legacy product used to manage maintenance of railcars within repair depot
- Internationalization of server & mobile field devices
- Entire User Interface was updated with new architecture

Technologies Tasks

- .NET 4.5
- ASP.NET MVC4
- .NET 2.0 for PockePC
- PHP

- 400 UI screens
- Mobile app
- Integrate with Agile team
- Unit test all screens

Project Size

4 person project for 6 month duration





Key Management System (Wayside & Locomotives)



Scope of Work

• Develop Key Management System for storage and distribution of cryptographic keys for communication managers for wayside equipment and locomotives

Technologies Tasks

- C++
- Python
- Q
- MySQL 5.7
- Linux CentOS 7
- Angular 6
- OpenSSL

- Requirements review
- Software design / implementation
- Test plan / test case definition
- Test case execution
- System Verification & Validation
- System integration & deployment
- System documentation



Project Size

4.5 person project for 10 month duration





- Port Meteorcomm ITCSM / ITCM software to run on Wayside Interface Units (MicroLok)
- Implement improvements for real time environment: threads, memory management, static libraries
- Defect resolution in Meteorcomm source code

Technologies

• Embedded Linux (uCLinux)

- C / C++
- GCC

Tasks

- Software Architecture
- Software Development
- Unit Testing
- Functional Testing

Project Size

4 person project for 16 month duration



Interoperable Train Control for Wayside Interface Units



Scope of Work

- Implementation control for remote management of Wayside Units (MicroLok)
- Implement communications interface with remote User Interface
- Secure connection via TCP/IP communications

Technologies Ta

- Embedded Linux (uCLinux)
- NiOS2 Altera CPU
- C/C++
- GCC

Tasks

- Software Architecture
- Software Development
- Unit Testing
- Functional Testing

Project Size

3 person project for 7 month duration





Programmable Hardware for Precision Station Stop



Scope of Work

- Prepare complete product documentation package
- 2 out of 2 implementation for safety critical decision
- Support hardware bring-up activities

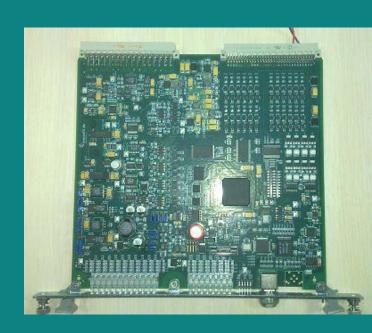
Technologies Tasks

- Cyclone II FPGA
- Altera Quartus II
- ModelSim 6.1e
- LabVIEW

- Requirements, Architecture, Design, and Testing Specifications
- Firmware Implementation
- Test Case Implementation
- Board Bring-up

Project Size

3 person project for 9 month duration; Subsystem Development



Memory Daughter Card for Vital Processor Module



Scope of Work

- Reverse engineer System Requirements for hardware (MicroLok)
- Hardware design
- Firmware implementation
- Locate and coordinate manufacturing (~ 500 units annually)

Technologies Tasks

- Altium Designer
- CPLD

- Systems Engineering
- Hardware/Software Design
- Implementation
- Production Coordination

Project Size

2 person project for 4 month duration; Turnkey Development





Remote Management of Wayside Interface Units



Scope of Work

- Implement User Interface within browser to manage remote hardware
- Implement communications interface for remote Wayside Units
- Secure connection via secure shell and TCP/IP

Technologies Tasks

- Linux
- C / C++
- SSH
- TCP/IP

- Software Architecture
- Software Development
- Unit Testing
- Functional Testing

Project Size

3 person project for 6 month duration







- Integrate MicroLok II into existing 15 miles of track
- ✓ Interface control & indication of switches
- ✓ Interface control & indication of snow melters on switches
- ✓ Integrate controls for new LED signal lamps
- ✓ Integrate axle counting system on mainline to support interlocking train detection

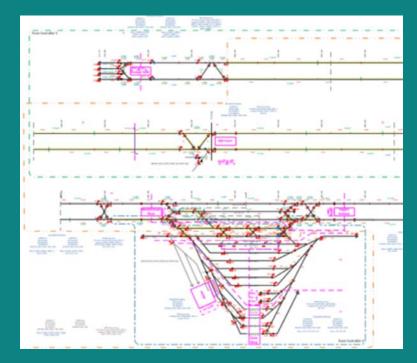
Technologies Tasks

MicroLok

Hardware Design

Project Size

1 person for 8 month duration (Completed); 1 person for 4 months (Planned)





Worcester Line in Boston (MBTA)

Scope of Work

- Design of signaling system for a distance 20 miles
- Integrate MicroLok with Ecode track circuits to handle signaling communications

Technologies Tasks

MicroLok

- Hardware Design
- Software Implementation

Project Size

2 person project for 3 month duration







- New signal design on 4 track territories
- Covers 14 miles of electrified track
- Support for a swing bridge

Technologies Tasks

MicroLok

- Hardware Design
- Software Implementation



Project Size

2 persons for 20 month duration (Completed); 2 persons for 27 months (Planned)



Dulles Corridor Metrorail Project Phase 2

Scope of Work

- Expedite project schedule
- Checking Hardware and Software designs
- 7 different tests for 10 locations

Ashburn (Route 772) TCRTCER	Loudoun Gateway (Route 606) TCR/TCER	Dulles Yard Junction West TCR	Dulles Yard Junction East TCR		Airport Wes	st	Dulles Airpor TCR	1	Airport East TCR	Innovation C TCR	enter	Herndon TCR/TCER		Reston Town Cents TCR
N12	N11	N98B	N98A	,	N97	ļ	N10	,-	N96	N09	-	N08	-	N07
7 -	_/			_								\mathcal{T}		
\ <u> </u>	Yan	Lead		_	X	_ :		-		\square				
7—V	Yan	ILead CR		_	X				Location Nam		Location Code			Configuration
\ <u> </u>	1	ilead CR		_	X				Location Nam Route 772 TCR/TCER	ne N	Location Code	Surface Stat	ion, Terminal	
	1	CR		-	X						Location Code 2	Surface State Storage Trans	ion, Terminal	DX-O and
	1	CR		_	X				Route 772 TCR/TCER Route 606 TCR/TCER Dulles Yard Junction W	N: N: VestTCR N:	Location Code 2	Surface Stat Storage Tran Surface Stat Two Yard Le	ck D X-O cion, Emergen and Turnouts	D X-O and cy U-XO
	1	CR		_	X				Route 772 TCR/TCER Route 606 TCR/TCER Dulles Yard Junction W Yard Lead TCR	N: N: VestTCR N:	Location Code 2 11 188 19E	Surface State Storage Tran Surface State Two Yard Le D X-O and Y	ck D X-O cion, Emergens and Turnouts and Lead Turn	DX-O and cy U-XO out
	1	CR			X				Route 772 TCR/TCER Route 606 TCR/TCER Dulles Yard Junction W Yard Lead TCR Dulles Yard Junction Ea	N: VestTCR N: astTCR N:	Location Code 2 11 188 19E 18A	Surface Stat Storage Trai Surface Stat Two Yard Le D X-O and Yi X-O and One	ck D X-O cion, Emergen and Turnouts	DX-O and cy U-XO out
	1	CR			X				Route 772 TCR/TCER Route 606 TCR/TCER Dulles Yard Junction W Yard Lead TCR Dulles Yard Junction Ea Airport West TCR	N: N: VestTCR NS N: astTCR NS	Location Code 2 11 188 19E 18A	Surface Stat Storage Trai Surface Stat Two Yard Le D X-O and On X-O and On D X-O	cion, Terminal ck D X-O cion, Emergens rad Turnouts ard Lead Turn e Yard Lead Tu	DX-O and cy U-XO out
	1	CR			X				Route 772 TCR/TCER Route 606 TCR/TCER Dulles Yard Junction W Yard Lead TCR Dulles Yard Junction Ea Airport West TCR Dulles Airport TCR	N: VestTCR N: astTCR N:	Location Code 2 11 1888 199E 188A 17	Surface Stat Storage Trai Surface Stat Two Yard Le D X-O and Yi X-O and Oni D X-O Aerial Static	cion, Terminal ck D X-O cion, Emergens rad Turnouts ard Lead Turn e Yard Lead Tu	DX-O and cy U-XO out
	1	CR			X				Route 772 TCR/TCER Route 606 TCR/TCER Dulles Yard Junction W Yard Lead TCR Dulles Yard Junction Ea Airport West TCR	N: N: VestTCR N: N: AstTCR N: N: N: N: N: N: N: N:	Location Code 2 2 11 1888 1995 188A 177 0	Surface Stat Storage Trai Surface Stat Two Yard Le D X-O and On X-O and On D X-O	cion, Terminal ck D X-O cion, Emergens rad Turnouts ard Lead Turn e Yard Lead Tu	DX-O and cy U-XO out
	1	CR			X				Route 772 TCR/TCER Route 606 TCR/TCER Dulles Yard Junction W Yard Lead TCR Dulles Yard Junction Ea Airport West YCR Dulles Airport TCR Airport East TCR	NS N	Location Code 2 11 1888 888 77 0 0	Surface Stat Storage Trai Surface Stat Two Yard Le D X-O and Yi X-O and Oni D X-O Aerial Static U X-O D X-O	cion, Terminali ck D X-O cion, Emergens rad Turnouts ard Lead Turn e Yard Lead Turn in	DX-O and cy U-XO out

Technologies Tasks

MicroLok

- Hardware Design Check
- Software Design Check

Project Size

2 person project for 1 month duration



Train Control / SCADA System Testing



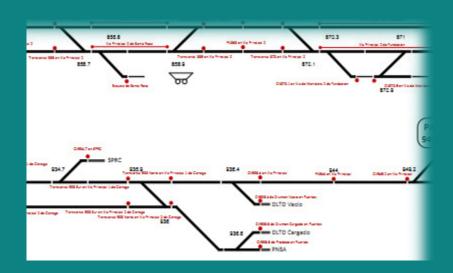
Scope of Work

- Analysis system requirements to develop test cases
- System level testing including: Authorities, Bulletins, & User roles
- Regression testing of update software releases

Technologies Tasks

- MS SQL Server 2012
- FactoryLink V8
- Rational Clear Quest
- VNC Viewer

- Software V&V testing
- Onsite factory testing



Project Size

2 person project for 8 month duration



ATP Unit Testing for Carborne

Scope of Work

- Perform white box testing of ATP modules for Carborne application
- 100% code coverage
- Define baseline testing for new metro lines
- Perform regression testing of maintenance releases

Technologies Tasks

- VectorCAST
- Vblok (custom tool)
- Define test cases
- Execute automated testing
- Prepare audit reports



6 Projects in 2018

Baseline 3 persons for 2 months; Regression 2 persons for 1 week





- Perform black box testing of ways ide application
- 100% code coverage
- Dead code analysis
- Baseline testing for new line

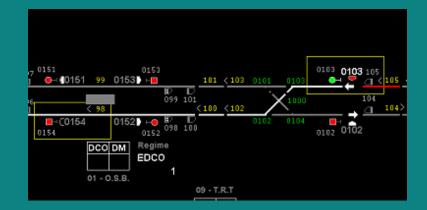
Technologies Tasks

VectorCAST

- Requirements review
- Define test cases
- Execute automated testing
- Prepare dead code report
- Prepare audit reports

Project Size

3 person project for 4 month duration





Professional Software Associates, Inc.

Office +1.727.724.0000 x200

Cell +1.810.338.0000

E-mail john@psa-software.com

Skype john.hertrich

Website www.psa-software.com