|  |  |
| --- | --- |
| A blue sign with silver border  AI-generated content may be incorrect. | Project Management DocumentationSPC Station Health Charts |

**Version:** 1.4

**Date:** October 7, 2025

**Project Duration:** September 28 - October 7, 2025 (10 days)

**Total Effort:** ~90 hours

**Enhancement:** Debug Tools & CSV Troubleshooting

## 1. Project Summary

### 1.1 Overview

Development of a Statistical Process Control dashboard for airline maintenance metrics, completed across three major iterations to overcome technical constraints and achieve correct statistical implementation.

### 1.2 Key Metrics

|  |  |
| --- | --- |
| **Metric** | **Value** |
| **Total Duration** | 9 days |
| **Total Effort** | ~80 hours |
| **Iterations** | 3 major rewrites |
| **Lines of Code** | ~1,600 |
| **Files Created** | 8 core files |
| **Test Data Points** | ~12,000 data points |
| **Charts Supported** | 24 simultaneous |

### 1.3 Team

* **Size:** 1 developer (AI-assisted)
* **Role:** Full-stack developer
* **Skills:** Python, JavaScript, SPC methodology, data visualization

## 2. Project Phases

### Phase 1: React + CDN Approach (Failed)

**Duration: September 28-29, 2025 (2 days)  
Effort: ~16 hours  
Status:** ❌ Abandoned

**Reason for Failure: Corporate firewall blocked CDN access to React and Recharts libraries**

### Phase 2: Standalone HTML + Initial SPC Logic (Partial Success)

**Duration: September 30 - October 3, 2025 (4 days)  
Effort: ~32 hours  
Status:** ⚠️ Required Major Corrections

**Issues: Phase detection logic incorrect; limits calculated from entire dataset**

### Phase 3: Wheeler's Rules Implementation (Success)

**Duration:** October 4-6, 2025 (3 days)  
**Effort:** ~32 hours  
**Status:** ✅ Production Ready

**Achievement:** Correct Wheeler's methodology; both X and mR charts; realistic phase detection

## 3. Epic Breakdown

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Epic** | **Priority** | **Estimated** | **Actual** | **Status** |
| **Epic 1: Core Infrastructure** | P0 | 20h | 40h | ✅ |
| Local Python HTTP server, Frontend foundation, CSV parsing, API endpoints | Note: Initial CDN approach added 16 hours of wasted effort | | | |
| **Epic 2: Statistical Process Control Engine** | P0 | 24h | 48h | ✅ |
| Control limits, Phase detection, X chart, mR chart generation | Note: Multiple corrections required for Wheeler's Rules | | | |
| **Epic 3: Data Visualization** | P0 | 16h | 24h | ✅ |
| Canvas-based rendering, Control limits display, Phase boundaries | Note: Canvas API more complex but provides full control | | | |
| **Epic 4: User Experience** | P1 | 12h | 16h | ✅ |
| CSV upload, Station filtering, PNG export, Error handling | Note: Format auto-detection critical for adoption | | | |

## 4. Sprint Breakdown

### Sprint Summary

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sprint** | **Dates** | **Duration** | **Effort** | **Outcome** |
| **Sprint 1** | Sep 28-29 | 2 days | 16h | ❌ Failed - CDN blocked |
| **Sprint 2** | Sep 30 - Oct 1 | 2 days | 16h | ⚠️ Partial - Charts render but phase detection incorrect |
| **Sprint 3** | Oct 2-3 | 2 days | 16h | ⚠️ Partial - Logic correct but test data unrealistic |
| **Sprint 4** | Oct 4-5 | 2 days | 16h | ✅ Success - Phase detection realistic |
| **Sprint 5** | Oct 6 | 1 day | 8h | ✅ Success - Production ready |

## 5. Velocity & Burndown

### Velocity (Story Points per Day)

|  |  |  |  |
| --- | --- | --- | --- |
| **Sprint** | **Planned** | **Actual** | **Efficiency** |
| Sprint 1 | 8 | 0 (failed) | 0% |
| Sprint 2 | 10 | 8 | 80% |
| Sprint 3 | 10 | 8 | 80% |
| Sprint 4 | 10 | 10 | 100% |
| Sprint 5 | 8 | 8 | 100% |

**Average Velocity:** 6.8 points/day (after accounting for failed sprint)

## 6. Risk Management

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **ID** | **Risk** | **Probability** | **Impact** | **Mitigation** | **Status** |
| R1 | CDN blocked by firewall | High | Critical | Use standalone approach | ✅ Mitigated |
| R2 | Incorrect SPC methodology | Medium | High | Research Wheeler's Rules | ✅ Mitigated |
| R3 | Performance issues (100+ charts) | Low | Medium | Use Canvas (GPU accelerated) | ✅ Avoided |
| R4 | Python not installed | Medium | Critical | Document in README | ✅ Accepted |
| R5 | Port 8000 in use | Medium | Low | Document how to change port | ✅ Accepted |

## 7. Lessons Learned

### What Went Well **✅**

1. **Pivot to standalone approach:** Eliminated external dependencies entirely
2. **Wheeler's methodology research:** Ensured statistical correctness
3. **Canvas rendering:** Excellent performance, full control over output
4. **Realistic test data:** Validated phase detection accuracy
5. **Auto-format detection:** Improved user experience significantly

### What Went Wrong **❌**

1. **Initial CDN approach:** 16 hours wasted on blocked solution
2. **Improvised phase detection:** 16 hours fixing incorrect statistical logic
3. **Unrealistic test data:** 3 hours regenerating data with proper variation
4. **Insufficient upfront research:** Should have validated constraints and methodology earlier

### Process Improvements

1. **Validate constraints first:** Check network, security, installation policies
2. **Research domain methodology:** Don't improvise statistical/scientific algorithms
3. **Realistic test data from start:** Ensures accurate validation
4. **Incremental testing:** Catch issues earlier (e.g., 6-point vs 8-point run)

## 8. Effort Breakdown by Category

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Category** | **Attempt 1** | **Attempt 2** | **Attempt 3** | **Total** | **%** |
| **Frontend** | 12h | 14h | 4h | 30h | 37.5% |
| **Backend** | 4h | 6h | 8h | 18h | 22.5% |
| **SPC Logic** | - | 6h | 12h | 18h | 22.5% |
| **Testing** | - | 4h | 4h | 8h | 10% |
| **Documentation** | - | 2h | 4h | 6h | 7.5% |
| **TOTAL** | 16h | 32h | 32h | **80h** | 100% |

### Waste Analysis

|  |  |  |
| --- | --- | --- |
| **Type** | **Hours** | **% of Total** |
| **Productive** | 64h | 80% |
| **Rework** | 16h | 20% |

Note: Rework = CDN approach (abandoned: 16h). Phase detection corrections included in productive (learning).

## 9. Project Timeline

Task Sep 28 29 30 Oct 1 2 3 4 5 6

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React + CDN Approach [████████]

└─ Setup & Development [██████]

└─ Debugging CDN issues [██]

Standalone HTML Rewrite [████████]

└─ HTML/CSS/JS foundation [████]

└─ Canvas rendering [████]

Initial Phase Detection [████████]

└─ Research Wheeler's Rules [██]

└─ Implement baseline logic [████]

└─ Test & debug [██]

Corrections & mR Charts [████████]

└─ Regenerate test data [██]

└─ Add mR charts [███]

└─ Final testing [█]

Documentation & Release [████]

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Legend: [██] = Work in progress

## 10. Deliverables

### Code Deliverables

|  |  |  |  |
| --- | --- | --- | --- |
| **Deliverable** | **Status** | **Lines** | **Complexity** |
| server.py | ✅ | ~200 | Medium |
| spc\_processor.py | ✅ | ~400 | High |
| load\_actual\_data.py | ✅ | ~150 | Medium |
| dashboard\_standalone.html | ✅ | ~900 | High |
| START\_DASHBOARD.bat | ✅ | ~10 | Low |
| start\_dashboard.sh | ✅ | ~10 | Low |
| Sample CSV files (4) | ✅ | ~12K rows | N/A |

**Total Lines of Code:** ~1,670

### Documentation Deliverables

|  |  |  |
| --- | --- | --- |
| **Document** | **Status** | **Est. Pages** |
| README.md | ✅ | 3 |
| README\_DISTRIBUTION.md | ✅ | 4 |
| PRD\_Product\_Requirements.md | ✅ | 12 |
| ARCHITECTURE.md | ✅ | 18 |
| FUNCTIONAL\_SPEC.md | ✅ | 22 |
| TECHNICAL\_SPEC.md | ✅ | 24 |
| PROJECT\_MANAGEMENT.md | ✅ | 16 |

**Total Documentation:** ~99 pages (estimated)

## 11. Quality Metrics

### Functional Quality

|  |  |  |  |
| --- | --- | --- | --- |
| **Metric** | **Target** | **Actual** | **Status** |
| **Critical Bugs** | 0 | 0 | ✅ |
| **Medium Bugs** | < 3 | 0 | ✅ |
| **User Acceptance** | 100% | 100% | ✅ |
| **Performance (Load Time)** | < 3s | ~1s | ✅ |
| **Browser Compatibility** | 95% | 100% | ✅ |

## 12. Success Criteria Review

|  |  |  |  |
| --- | --- | --- | --- |
| **Criterion** | **Target** | **Actual** | **Met?** |
| **Deployment Time** | < 5 min | 2 min | ✅ |
| **Zero Dependencies** | Yes | Yes | ✅ |
| **Wheeler's Rules** | Rule #1, #4 | Rule #1, #4 | ✅ |
| **Historical Data** | 2023+ | Jan 2023+ | ✅ |
| **PNG Export** | Yes | Yes | ✅ |
| **Station Count** | 3 | 3 (AUS, DAL, HOU) | ✅ |
| **Measure Count** | 4 | 4 | ✅ |
| **Chart Types** | X & mR | X & mR | ✅ |

### **✅** Overall: All Success Criteria Met **✅**

## Approval

|  |  |  |  |
| --- | --- | --- | --- |
| **Role** | **Name** | **Date** | **Signature** |
| Project Manager | Development Team | 2025-10-06 | ✅ Approved |
| Product Owner | Tech Ops Manager | 2025-10-06 | ✅ Accepted |
| Sponsor | VP Operations | 2025-10-06 | ✅ Signed Off |

**Document Version History**

|  |  |  |  |
| --- | --- | --- | --- |
| **Version** | **Date** | **Author** | **Changes** |
| 1.0 | 2025-10-06 | Development Team | Initial project management documentation |