R·I·T

P11582

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Automated Rivet Inspection

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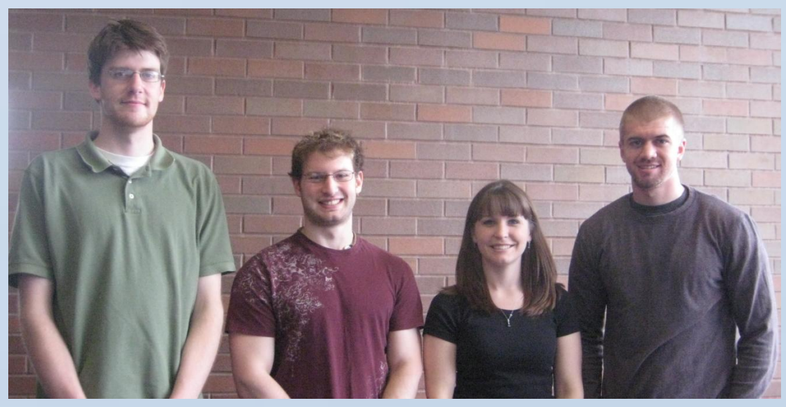
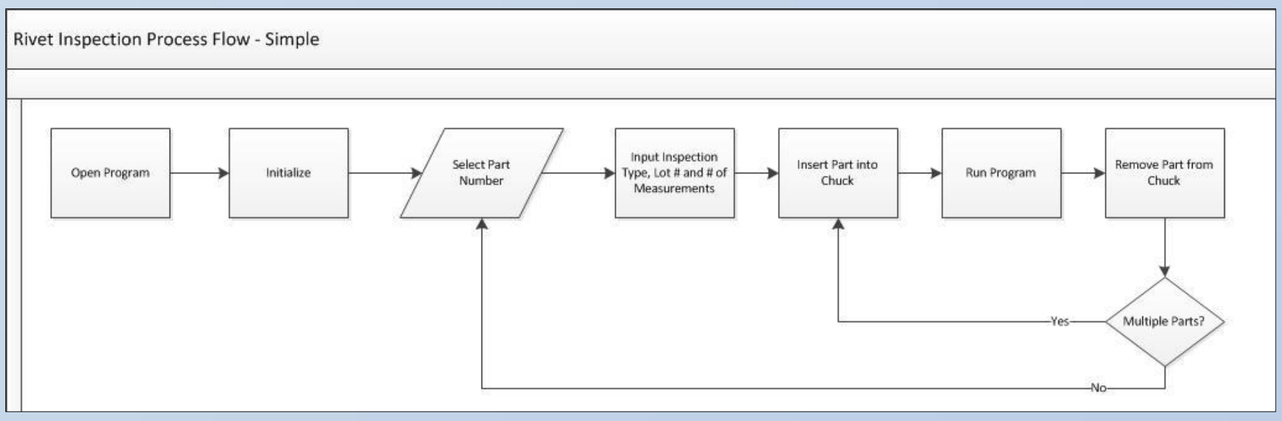


BACKGROUND

Cherry Aerospace, a division of Precision Castparts Corporation (PCC), SPS Fastener Division produces pull-type rivets for aerospace applications. The rivets are produced in large batches and need to adhere to the correct tolerances allowed. A sample of rivets is taken from the produced lots for inspection. Due to the large number of rivets produced daily it is impossible to perform 100% inspection. The key parameters of these rivets are measured manually by technicians through the use of micrometers and other metrology instruments. Cherry has been examining the market for a comparable product that would output the results they require.



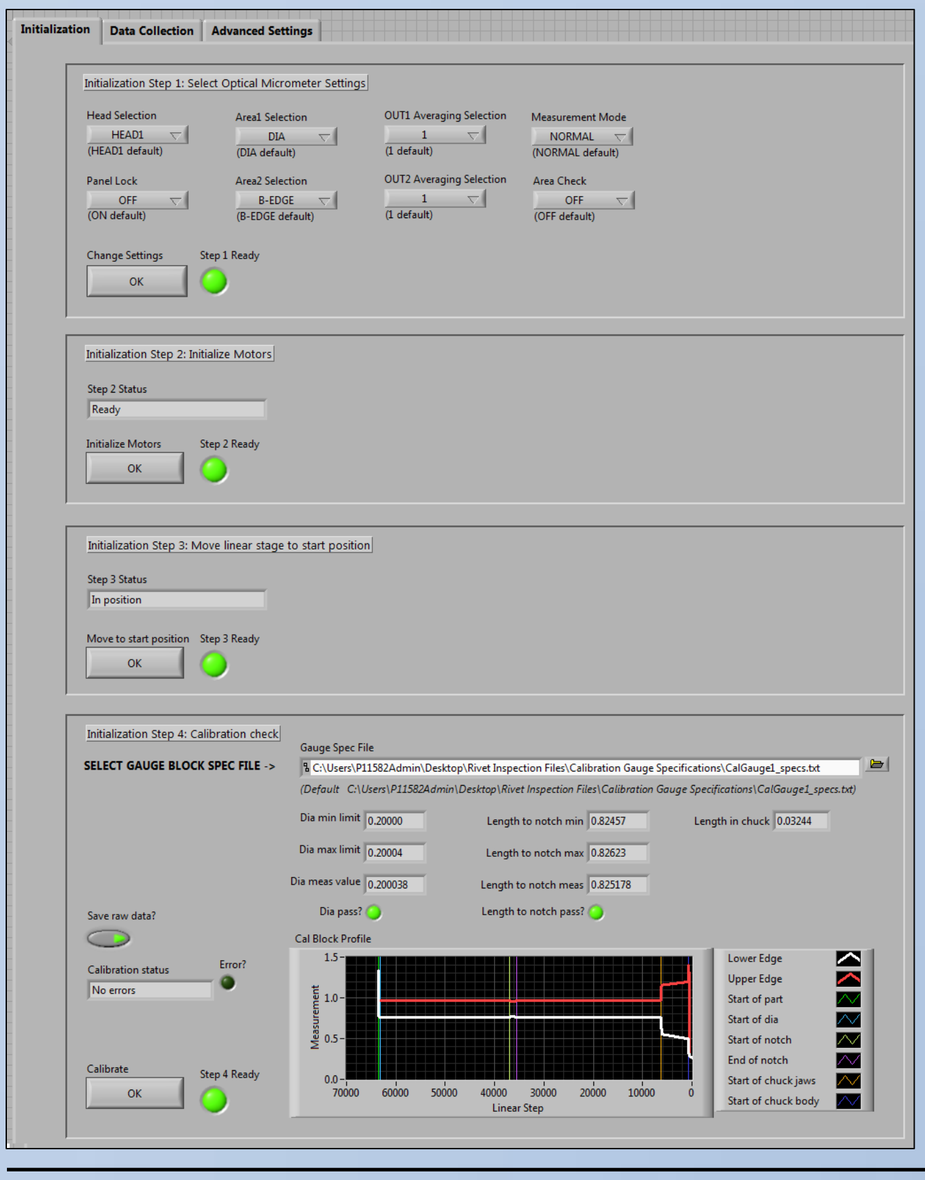
Deliverables:

- Measure all critical dimensions as specified by Cherry Aerospace
- Ability to compare inspection data with design values
- Highly automated
- Usable by personnel with minimal training
- Data analysis and data basing capability
- “Go/no-go" indication

OBJECTIVE

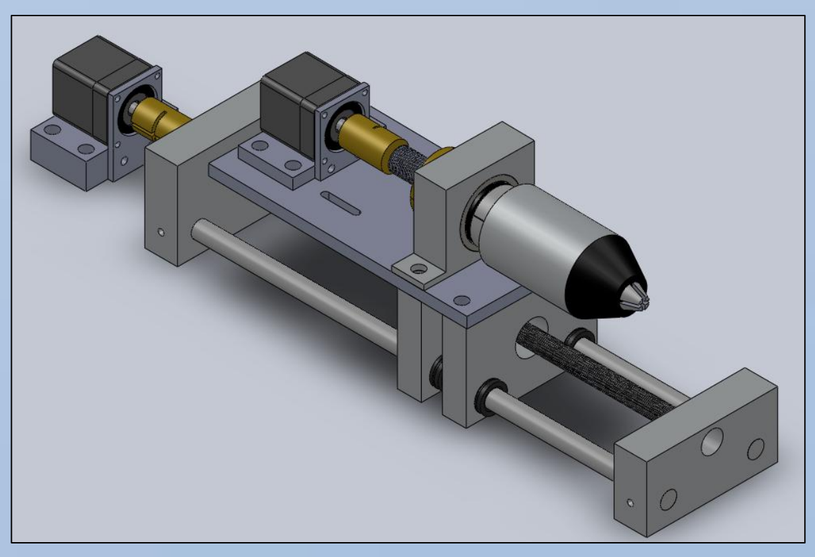
Design and construct an inspection tool to measure and validate critical rivet dimensions at high speed in high volumes and consolidate the inspection data for use in a real time statistical control process.

Customer Need #	Importance	Description
		System Needs
CN1	9	Simple user interface (Go/NoGo) for operators
CN2	9	Available 'technician mode' showing more options & features
CN3	9	Switch between different rivet models with minimal set up
CN4	3	Relatively portable (fits on cart top ~ 1-2 sqft)
CN5	3	Shielding to help withstand manufacturing environment
CN6	9	Training documentation provided with system
CN7	3	Low cost
CN8	1	Tests multiple parts at once
CN9	1	Autoloading
		Physical Measurement
CN10	1	Improved cycle time over hand measurement
CN11	9	Compatable with a variety of rivet models
CN12	9	Holds part without damaging it
CN13	3	Capable of measuring along entire length of rivet
CN14	3	Capable of rotating part 360 deg around main axis
CN15	9	Measures rivet body diameter
CN16	9	Measures rivet body length
CN17	9	Measures rivet body roundness
CN18	9	Measures rivet head diameter
CN19	9	Measures rivet head protrusion
CN20	3	Measures rivet head land thickness ("0.010 / 0.002")
CN21	9	Measures stem diameter
CN22	9	Measures stem length
CN23	9	Measures mandrel diameter
CN24	1	Measures mandrel roundness
CN25	9	Check that mandrel meets length requirement
CN26	3	Measures concentricity of rivet body to mandrel
CN27	1	Measures undercut angle
CN28	1	Measures undercut round
CN29	1	Checks presence of indented circle
CN30	1	Checks presence of washer
		Data Processing
CN31	9	Analyze data to accurately determine measured values
CN32	9	Veryify conformance of part based on input limits
CN33	3	Local storage of recorded measurements
CN34	1	Able to recall data saved locally
CN35	3	Perform SPC tracking from local data
CN36	9	Capable of transfering data to SQL server
CN37	9	Storage of multiple limit sets and analysis routines



LabVIEW Programming

- Serial communication for stepper motor control micrometer data collection
- Custom scripts analyze data and determine pass/fail of part, allow for databasing
- Sequences
  - Start-up initialization
  - Micrometer settings
  - Home motors
  - Bring motors to start position
  - Confirm system calibration
- Data analysis
  - Scan rivet profile
  - Determine locations of critical features
  - Calculate lengthwise measurements
  - Rotate rivet at defined locations
  - Calculate diameter, roundness, concentricity
  - Save results to file
  - Report results to operator



Components:

- Digital Micrometer
  - Purchased from Keyence
- Custom built Linear and Rotational Stages
  - Manually fabricated using RIT’s machine shop
- Chuck
- Stepper Motors
- Motion Controller
- Protective Enclosure

For additional information visit our site at:
http://edge.rit.edu/content/P11582/public/Home

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