Rotating Machinery Services, Inc.

CENTRIFUGAL COMPRESSOR IMPELLER

By Dean Curtis

RMS secured a contract to replace a 50” diameter closed wheel impeller. As the original drawings were not available we are re-engineering the impeller wheel from what little OEM data was available and the existing heavily eroded wheel shown in Figure 1.

Figure 1

The job is complicated by having to reproduce the complex curves of the rather inaccessible blade geometry. Our process enables us to reverse engineer the wheel in parallel with manufacturing it which greatly reduces lead times. Our depth of experience makes the finished product work.

We inspected the wheel using several different methods which we then compared to each other to both validate our process and determine which features were most well preserved to base our new design upon. We took measurements using a combination of methods: Traditional precision measurement using standard shop equipment, our Faro arm for single point and laser scans, a Repro Rubber mold of an entire impeller blade, and an experimental foam mold of impeller blade geometry. The molds were also Faro arm scanned and validated. Our data was checked against itself, exported as a point cloud to SolidWorks, and used to create a solid model.

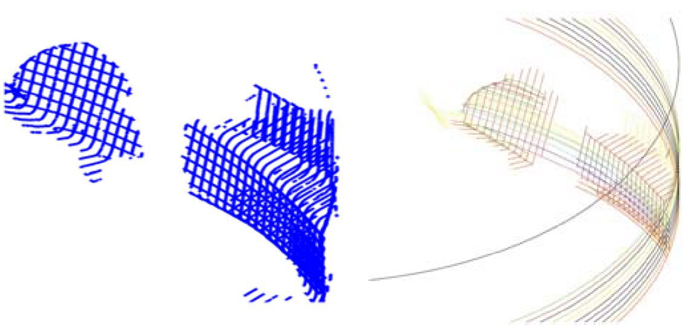

Figure 3

Upon creation of final models, those features were exported to AutoCAD and detailed for sourcing to our vendors. IGES files were created for structural analysis in house. Our experienced design team has a depth and breadth of abilities in many different design methodologies that enables us to leverage several different software packages, and cross check results, using the best of each to our and our customer’s advantage. Simultaneously, our in house X-ray fluorescence materials analyzer enabled us to rapidly identify and source the right steel for the job.

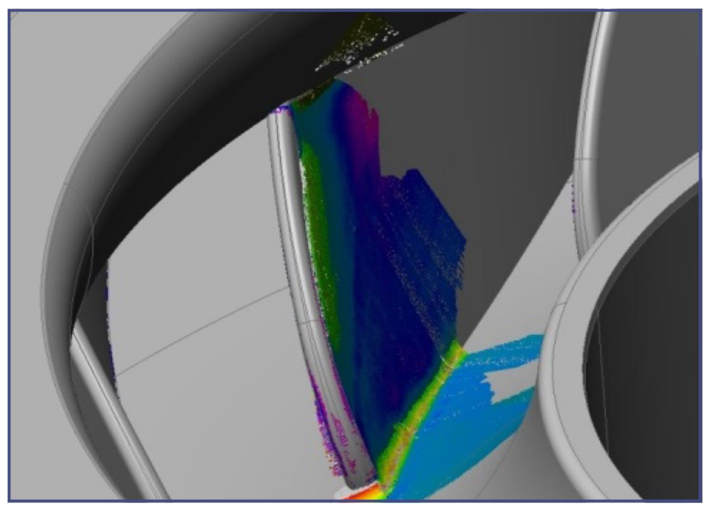

Figure 2

Critical airfoil geometry such as exit angle, chord width, and inlet throat geometry were measured several different ways. Those measurements were used to create a solid model in SolidWorks. That geometry was aligned to our original scan data using our inspection modules in Polyworks. The graphical representation of those results shows an excellent correlation between the SolidWorks geometry we created for this preliminary model, and the scanned geometry of the wheel, with appropriate deviations where we added material to compensate for the erosive wear.

A particularly difficult challenge is flattening the compound blade geometry for our suppliers to replicate the blade geometry in flat plate, and then bend and twist it into shape. We developed AutoCAD drawings by “flattening” the blade geometry using differing mapping techniques adapted from cartography and sheet metal work. One of RMS’s unique advantages is the diverse knowledge base of its leadership, employees, and suppliers. We can attack a problem from many different angles at once, working along parallel paths to shorten lead times, and proved a superior product in a shorter time frame. Our responsive, creative approach uniquely positions us as a ‘go to’ source for complex engineering challenges in the industry.

Figure 4

Figure 5

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