TYPICAL AIRFOIL PROCEDURE

SCAN PROCESS:

The scan can occur at your facility or ours. In many cases it is most cost effective for the digitizing or scanning to take place at our facility. However, in certain instances when turnaround time is of great importance or down time of the scanned component is critical, the scanner is mobile and available for on-site operation.

The airfoils that are typically provided by will be received by Exact Metrology for full documentation with photos, measurements and any surface markings or serial numbers recorded prior to any high definition scanning.

Setup

The mobility of our scanner enables us to be flexible in performing on-site scans (Option A) at your facility or the more cost efficient in-house scan at our facility (Option B).

Due to the reflective nature of the blades a thin coating of Magnaflux spray will be applied. The SKD-S2 spray is a second phase of the crack checking processes. (Phase 1 is a die penetrant that will not be used). The spray meets the requirements for AMS 2664, ASTM E165 and is ASME approved. (Health – 1, Flammability – 4, Reactivity -0, No Specific Hazard). See MSDS 0166 for more information on the SKD-S2 product.

When scanning the blade, we will be using a fixture device as shown on the right. Targets will also be used to constrain data during the alignment phase. Targets will be placed using magnets on either side of the air foil. The fixture itself will also act as an alignment constraint while holding the airfoil in place and allowing us to capture maximum data on the part without moving or touching the part. A manual or automatic turntable may be used to allow enhanced scanning and registration access to the part.

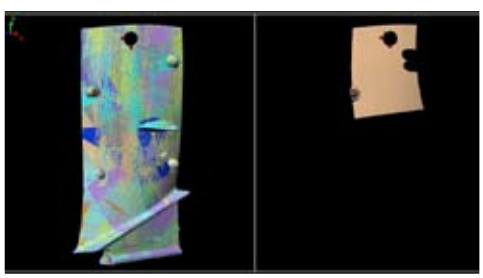
Scanning

The part is positioned on the rotating table or on a stationary marble top and scanned from multiple perspectives. This procedure is repeated multiple times to provide complete coverage of the part. Known geometric objects, cubes and spheres are often placed in the scene for quality assurance and validation during the validation stage.

The scanner used on these projects is a Breuckmann Stereo 3D Scanning system. This device uses a unique halogen structured white light projection system with dual 6.6 mega-pixel cameras. The scanner is the highest resolution scanner available on the market and was specially built for Exact Metrology in Germany. The illustration shown is of the actual stereo scanner that will be used on this project.

Registration

The registration process can be done with or without targets. Both registration methods have different techniques with similar result. Essentially, the targeting procedure uses automated fitting of point clouds or scan worlds together based upon 3 common positions on the part or scene. This process has been simplified with modern software technology. The software will then analyze every point with overlap and run a best fit algorithm over hundreds of iterations to find the tightest and best alignment. The result of this process will yield a fully registered and organized point cloud



Validation

It is important to verify the automated method with targeting and adding known geometric shapes to the scan. All scans are documented with notes, computer logging and digital photos accompanying the recorded scan setup within the software. A CD copy of all digital data is recorded prior to returning the part or teardown.

MODELING PROCESS:

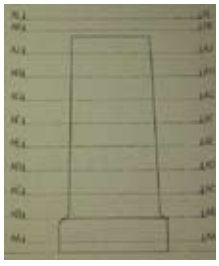
Once the data is gathered and the registration process is complete, the point cloud or data set can now be worked. The first step is to triangulate or mesh the points together. As part of this early process, points are "intelligently" removed from the network by algorithms in the software. Essentially, the points of redundancy and overlap are decimated and averaged. This mesh is further manipulated by reducing the triangles and points along flatter areas and retaining more triangles in areas of curvature and complexity. This poly mesh can now be exported as a complete *.STL file or similar format.

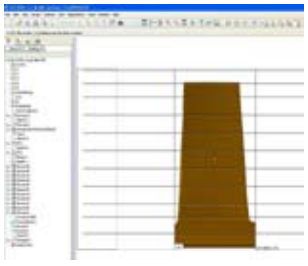
SURFACING

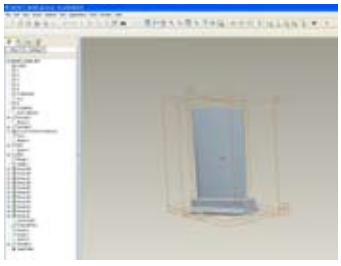
The process of fitting NURBs and geometry to the poly mesh or point cloud can be a time consuming and arduous process. A surface is basically draped over the mesh and smoothed to be reflective of the actual part. Once this task is completed and a complete water-tight object is created, the model is ready to be exported to nearly any format via a number of methods. The end file format is entirely up to the client and the limitations of existing conversion tools available today. A final 3D solid model can be provided in as a "dumb solid" with no parametry or history tree as an imported object. The available formats include: UG NX, Pro/E Wildfire, AutoCAD, AutoCAD Inventor, SolidWorks, as well as generic formats such as IGES, STEP, ParaSolid (X_T), as well as others.

PARAMETRIC MODELING

The final deliverable is a parametric model. Unlike a solid model, the parametric model possesses relationships of all dimensions within the CAD. With these relationships the CAD model can be manipulated and fine tuned without disturbing the overall geometry of the part. For this matter, the specific parameters of each cross section within the model can be independently modified without disturbing neighboring cross sections. The end result is a Pro/Engineer CAD model with known geometry that is fully adjustable and possesses a design history.







Point Cloud

Triangulated Mesh

Curve Network

Fitting of NURBs

Final Solid Mesh

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