

PRO-SPOT Measurement Report

Introduction:

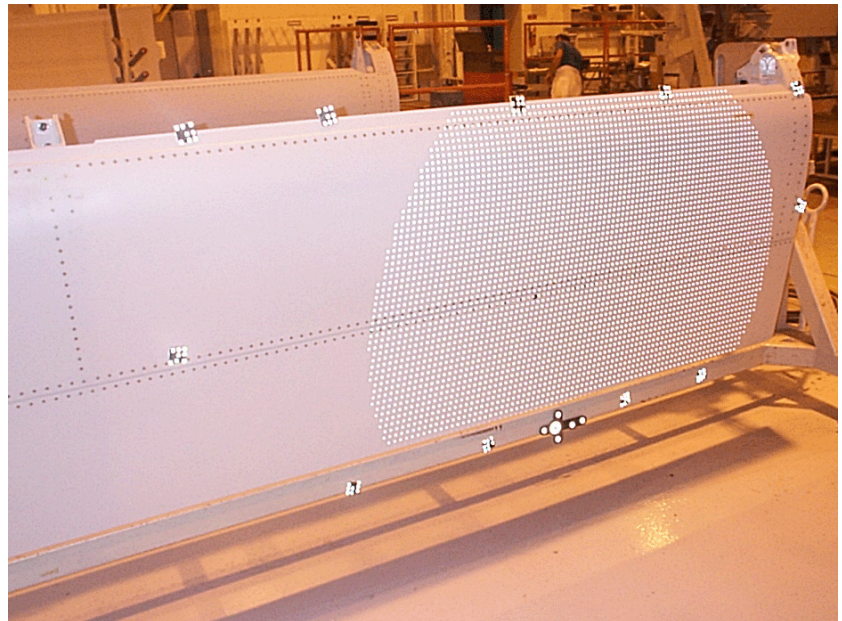
The following report is a summary of the PRO-SPOT work carried out at the Northrop Grumman facility in Stuart. Two measurements were undertaken using a new target projection system. The first piece was a long, slightly curved section of the flap. The objective was to determine surface data in a 65" section of the flap. The second piece was a 777 engine cowl. In this measurement the inside surface was determined.



Object 1 – Flap measurement

Primary Measurement Requirement:

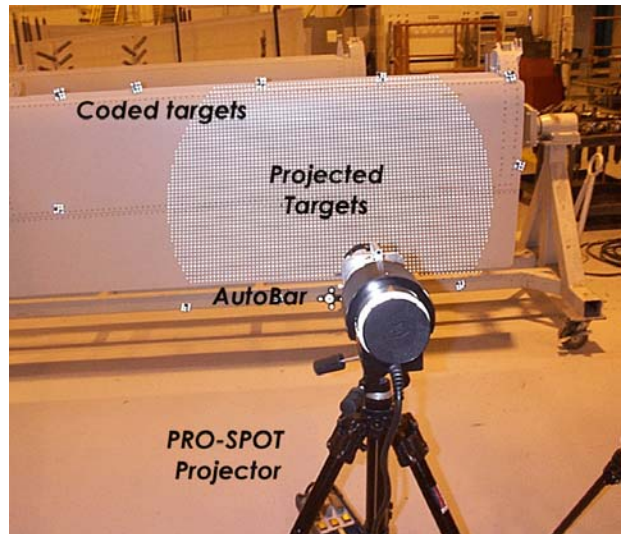
- Determine location of multiple surface points



Targeting.

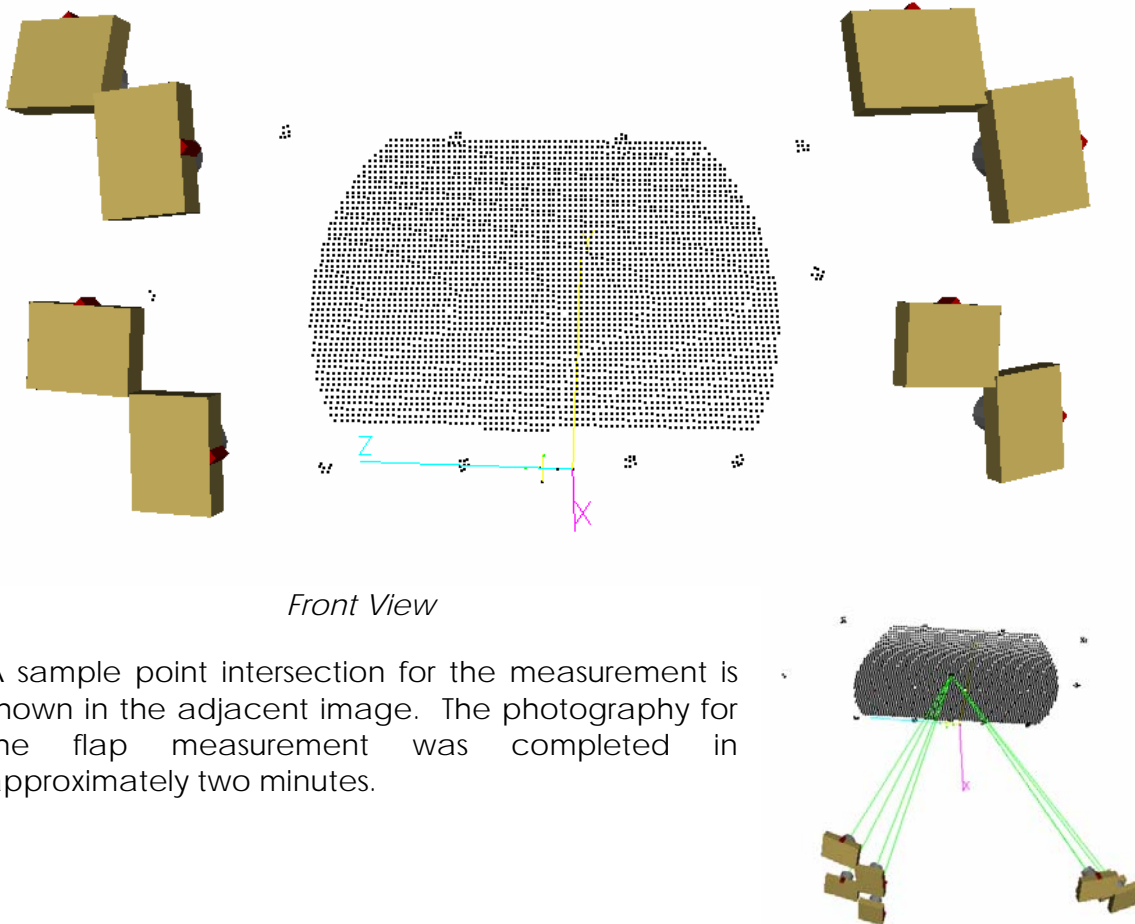
Targeting for this measurement was very simple. Coded targets, and an AutoBar were added to the area surrounding the area of interest for the measurement.

The surface targets were generated using the PRO-SPOT projector. A modeling light was used to focus and position the array of targets. The adjacent image shows some of the key targeting and the position of the projector.



Photography

A total of 8 photographs were taken for the flap measurement. The network configuration is shown in the image below.

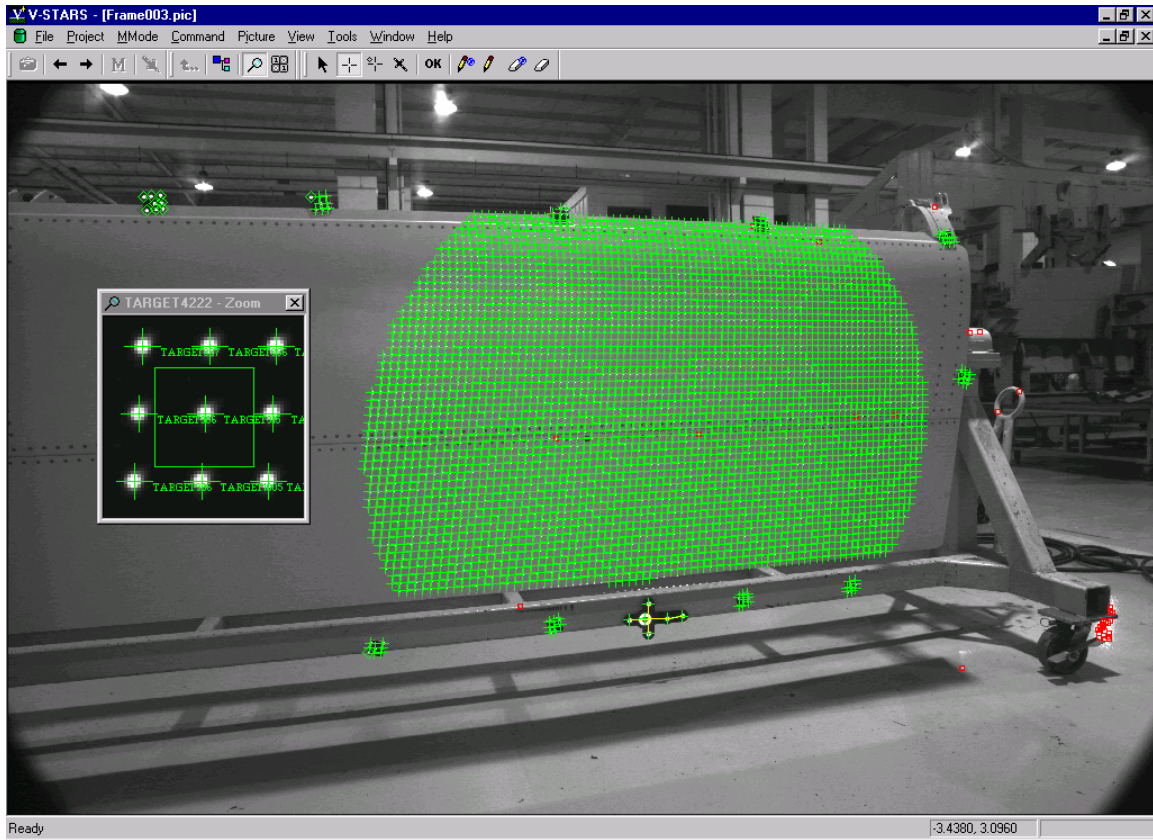


Front View

A sample point intersection for the measurement is shown in the adjacent image. The photography for the flap measurement was completed in approximately two minutes.

Processing

Seen below is an image taken as part of the measurement.

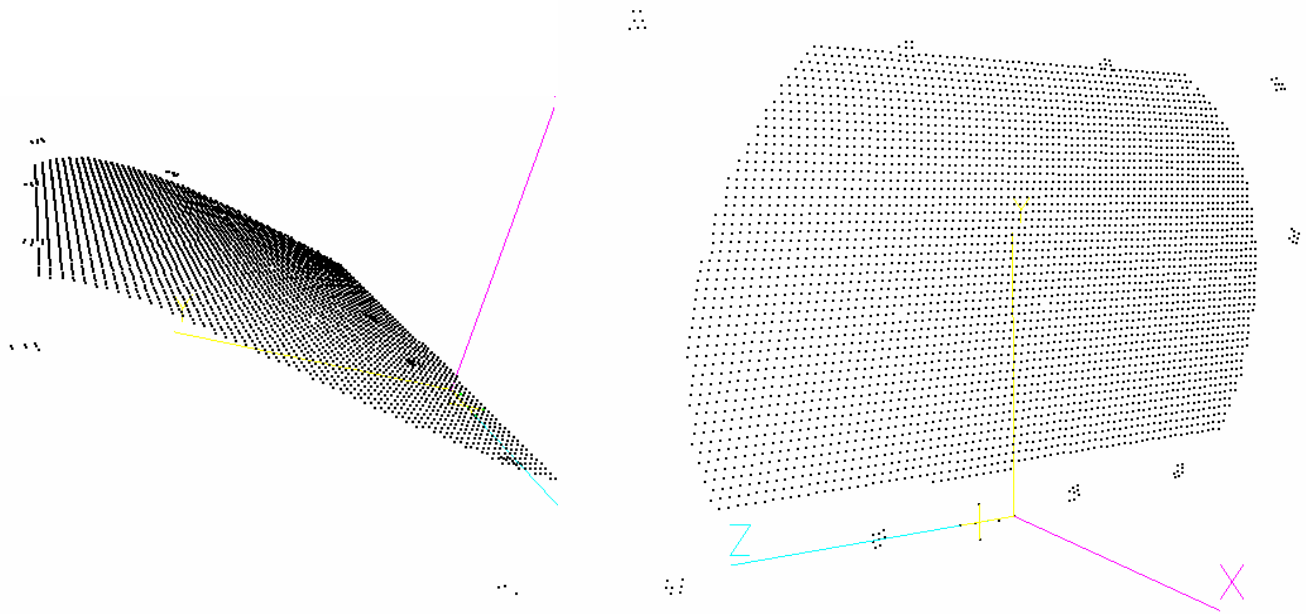


The following is a summary of the measurement statistics from the measurement.

No of photos	8		
No of points	4158		
RMS(") X,Y,Z		X	0.0007
		Y	0.0003
		Z	0.0003

The processing was completed in less than five minutes.

The point cloud for the part is shown below:



Alignment

No alignment was completed for the flap measurement. An alignment for the part could have been implemented using the edge of part and other features such as the hinge line.

Analysis

No analysis was completed on the part. If the part had been aligned and an IGES file was available it would be possible to compare the point data to the design surface. Deviations from the surface would then appear as a color map. Alternatively the point data can be exported from V-STARs and then imported to almost any CAD package.

Time Summary

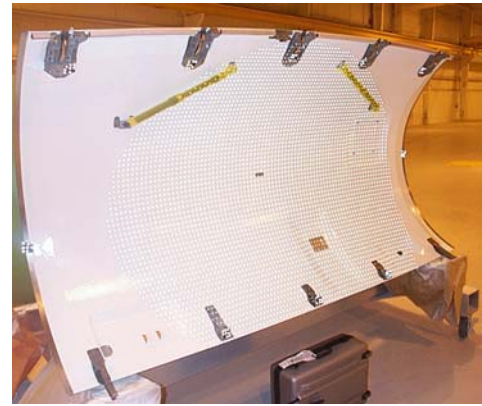
The following is an estimate of the time taken to complete the measurement.

Targeting	1 minute
Photography	2 minutes
Processing	5 minutes
Total	9 minutes

Object 2 – Inside Engine Cowl Measurement

Primary Measurement Requirement:

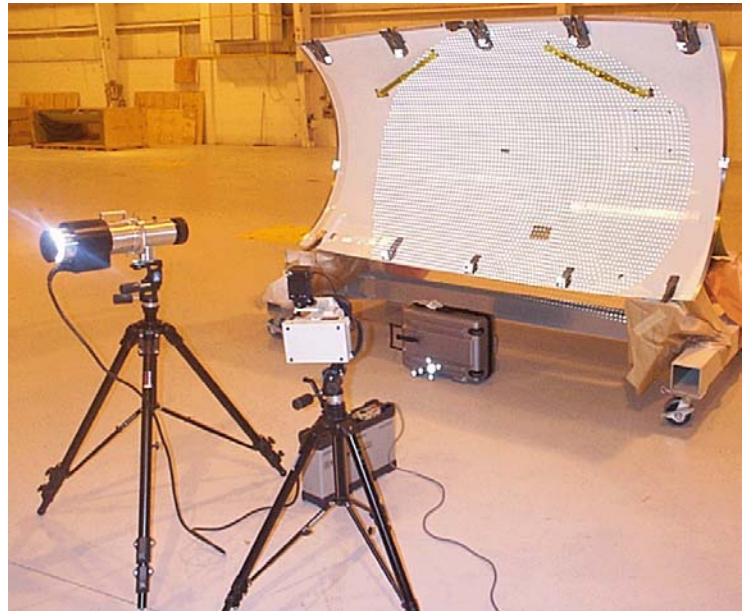
- Determine location of multiple surface points on the inside surface of an engine cowl.



Targeting.

Once again targeting for this object was very simple. Coded targets, and an AutoBar were added to the area surrounding the area of interest for the measurement.

The surface targets were again generated using the PRO-SPOT projector. The adjacent diagram shows some of the key targeting and the position of the projector.

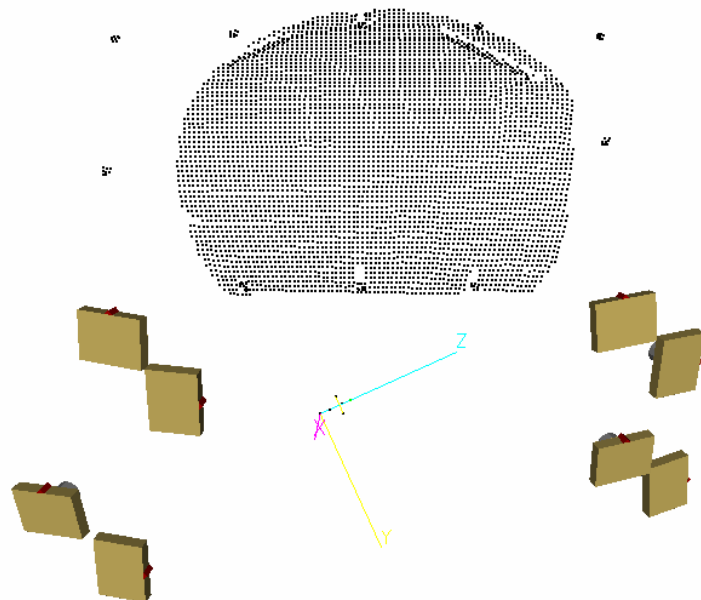


Targeting of the door consumed approximately a minute.

Photography

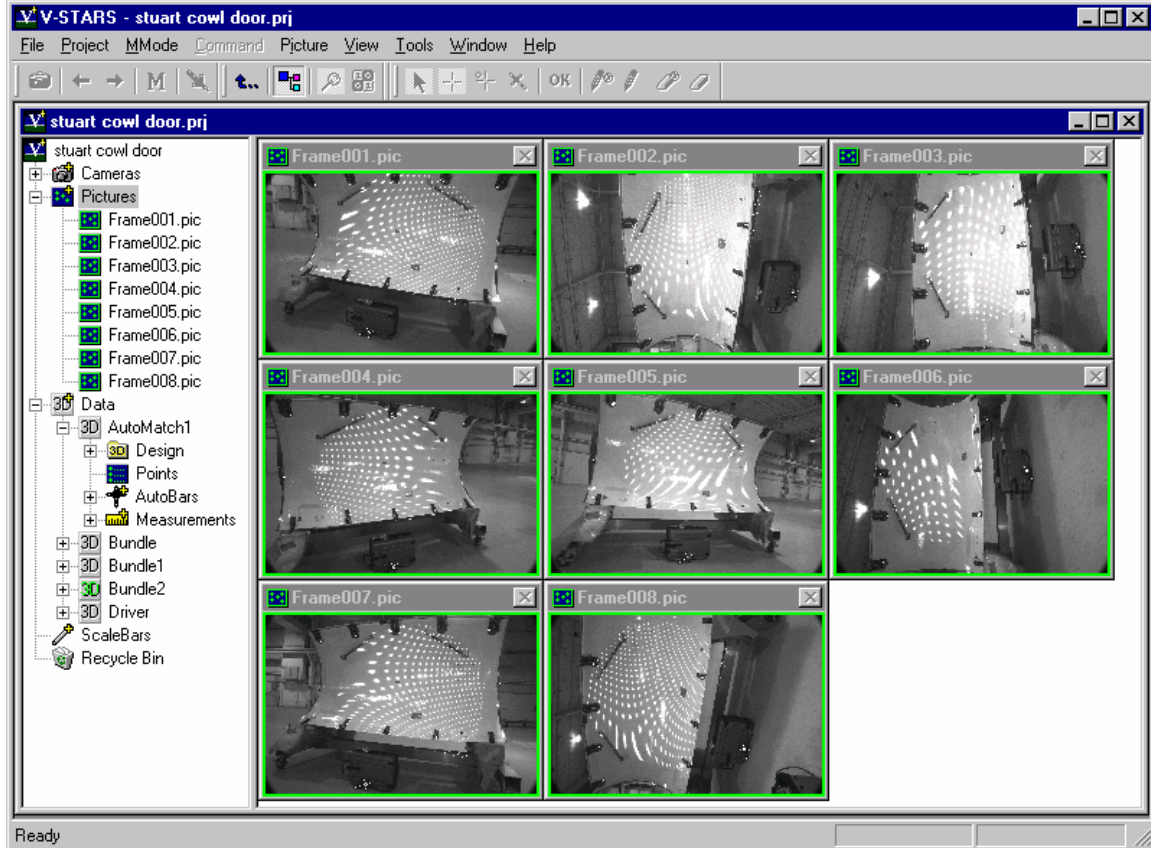
A total of eight photographs were taken of the engine cowl. These were distributed around the vicinity of the part. The network configuration is shown in the adjacent image. A sample intersection diagram is shown below.

The photography of the cowl was completed in approximately a minute.



Processing

Seen below as the images taken as part of the cowl measurement.

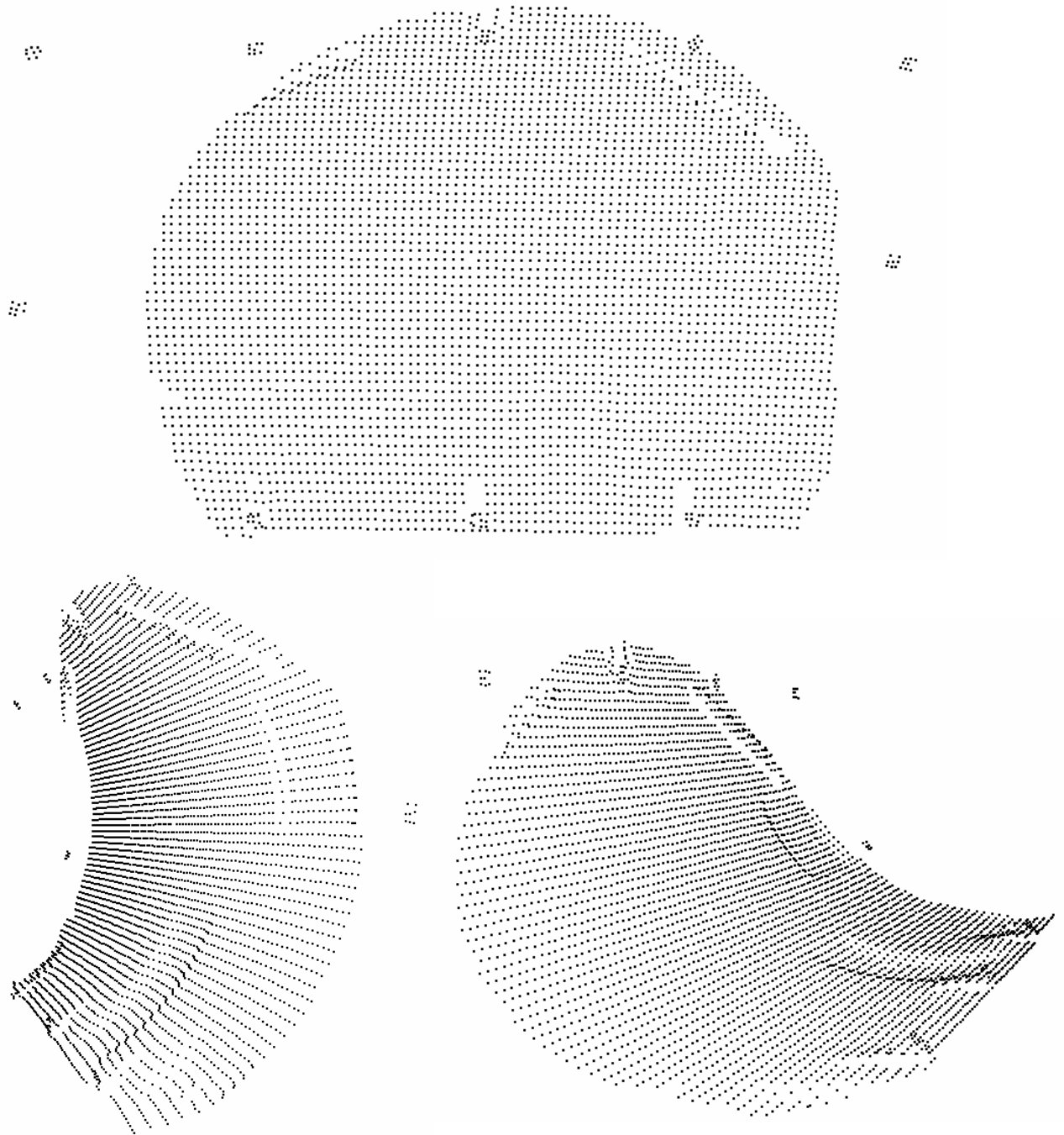


The following is a summary of the measurement statistics from the measurement.

No of photos	8		
No of points	4500		
RMS(") X,Y,Z	X	0.0009	
	Y	0.0005	
	Z	0.0004	

The processing was completed in less than three minutes.

Point cloud diagrams are shown below:



Time Summary

The following is an estimate of the time taken to complete the measurement.

Targeting	1 minute
Photography	1 minute
Processing	3 minutes
Total	5 minutes

Discussion

The PRO-SPOT projector system has demonstrated how large volumes of high accuracy surface data can be collected very quickly. Once again the results of the measurement are very accurate and more importantly were produced quickly.

Advantages of this technology over other measurement technologies include: -

1. Non-contact

Once again the measurement technique is completely non-contact. There is no surface deviation due to measurement contact with the surface.

2. Variable data collection rates

The number of points collected on the surface can vary from as few as 600 to as many as 6,000. The time needed to collect the point data is the same regardless of the different point densities.

3. Fast Data Acquisition

The information necessary to create the point data is collected in a matter of minutes. This makes the system ideal for a production environment where time constraints are critical.

4. Flexibility

The PRO-SPOT system is flexible enough to handle a wide variety of surface measurement tasks. For a large component, the projector can be moved to a new set up and the data incorporated together. Alternatively a second projector could be added.

5. Portability

The system can easily be packed up and carried to a supplier or customer for on site measurement tasks.

Concluding Remarks:

The measurements undertaken have shown that V-STARS and the target projector can be a very powerful inspection tool. The results of the measurement are very accurate and more importantly were produced quickly. With correct planning and targeting this data acquisition time could even be reduced further. There is also great scope use this technology to complete part inspections.

GSI would like to thank Northrop Grumman for welcoming us into their facility. We will be happy to discuss the results of this report or any other aspect of the technology presented.