

Protecting Intellectual Property When Publishing 3-D Models

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ABSTRACT

Light-weight 3-D models offer improved communication and visualization for advertising, marketing, service technicians, suppliers and other business partners. These models also may be a ready source of geometry and a window into a company's intellectual property for miscreants seeking to pirate designs and to produce counterfeit or will-fit parts.

What approaches and tools are available to help protect a company's intellectual property while enabling it and its business partners to benefit from widespread distribution of 3-D animations and models? How should they be applied to effectively protect intellectual property?

This paper provides a general survey of techniques available for protecting intellectual property in 3-D models when sending these files outside of a company and into broad distribution.

INTRODUCTION

This paper is not intended to deliver legal advice. If questions arise or there is a desire to apply the techniques it describes, consult with a lawyer before proceeding.

Intellectual Property (IP) is one of a company's most important assets. IP consists of the company's accumulated knowledge of product design and manufacturing and its ideas and identity. Hot-spots of IP activity usually discussed in publications include:

1. Trade Secrets
2. Trademarks
3. Privacy¹

Trade Secrets normally involve information of economic value. To be a Trade Secret, the information must not be generally known and must not be easily learned.¹

Three-dimensional models of a company's parts and products certainly have economic value and thus have the potential for being treated, and protected, as trade secrets. However, broadly distributing models outside of the company, sending them "into the wild," without taking adequate steps to protect the IP contained in them, increases the risk the IP may be determined by a court of law to be "easily learned" or "generally known." The action of broadly distributing three-dimensional models may result in their IP not being afforded legal protections provided by laws applying to Trade Secrets.

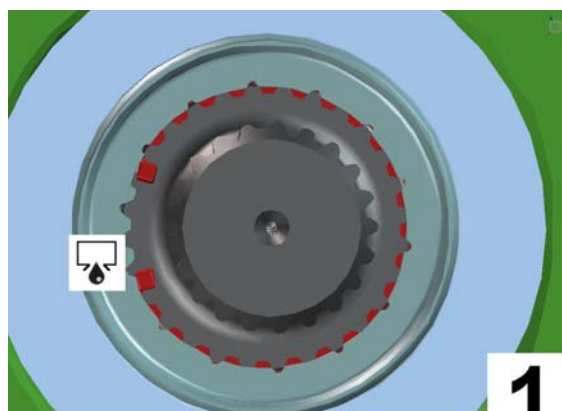


Figure 1 – View of Low Accuracy 3-D Splined Shaft

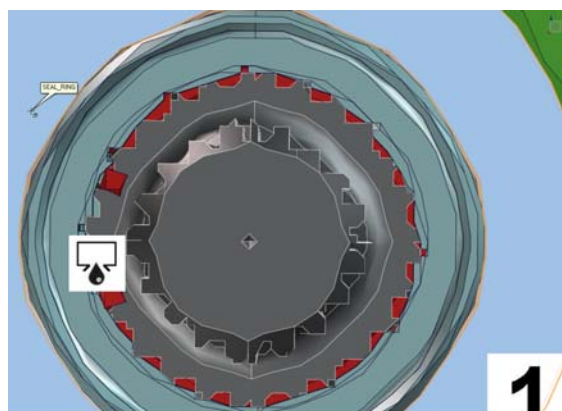


Figure 2 – View of Previous Shaft, High Accuracy

Personal Computers (PCs) have improved to the point where most PCs sold within the last four years are able to effectively display “light-weight, three-dimensional models” (3-D models). In addition 3-D modeling and data compression technologies have significantly reduced the file size necessary to store 3-D models while commonly available network band-widths have been increasing as have computer storage capacities. The results of these combined improvements are the ability to consider 3-D models or animated 3-D models as alternatives to PC based still photographic or line-art images and to video files.



Figure 3 – Virtual Photograph Using a 3-D Model

This improved and generally available technology and the communication effectiveness of 3-D models are leading the models to be used in applications outside of traditional application areas of engineering and manufacturing. As one example, Microsoft's Vista operating system's user interface is based upon the display and manipulation of three-dimensional objects. The use of 3-D models has grown beyond their exchange between limited numbers of professionals within large businesses. Indeed, 3-D models are now being distributed and published in support of advertising, marketing and product support applications. This results in increasing numbers of 3-D models being distributed and available outside of companies.

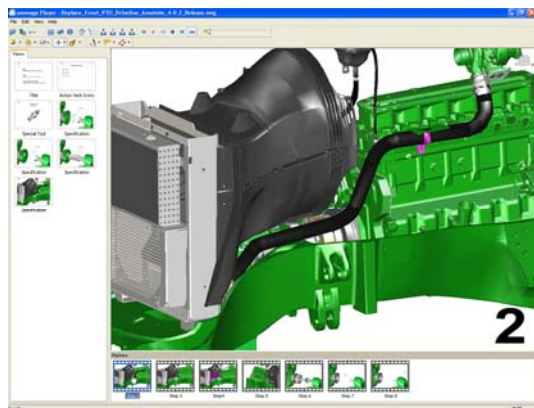


Figure 4 – Remove & Replace Procedure Using 3-D

Unfortunately, along with increasing use and distribution of 3-D models, comes greater risk of the models being used for unintended purposes. The danger resulting from greater accessibility to 3-D models is leveraged by increasing power of viewing and analysis tools. Some animation and model viewers support the ability to make measurements to a fair degree of accuracy. In addition, there are reverse-engineering applications enabling scans of physical parts to be quickly converted into CAD models approximating the original design and into numerical control programs for machining the scanned shapes. Computer calculation power continues to develop according to Mohr's Law and reverse-engineering applications continue to increase in capability. It does not take much imagination to visualize light-weight 3-D models as another form of scanned “point cloud”, suitable for reverse engineering. Increasing availability of 3-D models and increasing abilities to reverse-engineer make emerging “libraries” of 3-D models tempting targets for miscreants interested in stealing a company's IP.

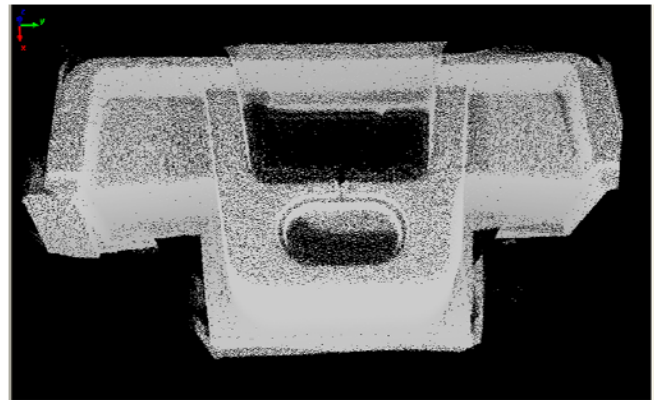


Figure 5 – Point Cloud of Scanned Part - courtesy of FARO Technologies, Inc.

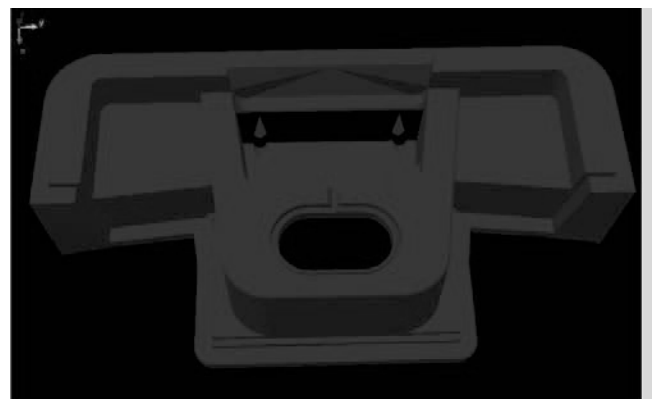


Figure 6 – 3-D CAD Model from Point Cloud - courtesy of FARO Technologies, Inc.

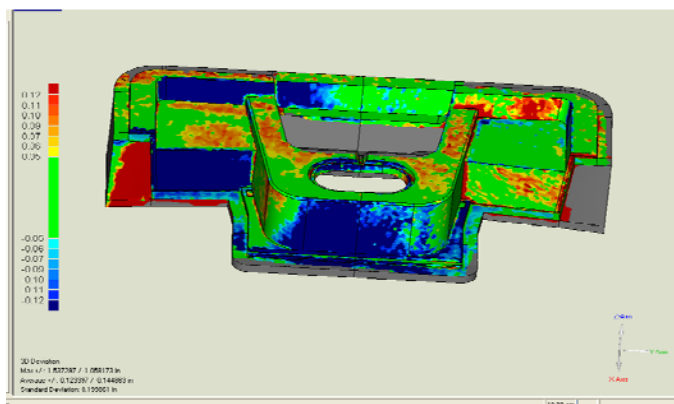


Figure 7 – 3-D CAD Model Comparison to Point Cloud - courtesy of FARO Technologies, Inc.

Around the beginning of June of 1944, the former Soviet Union started to reverse-engineer four B-29 Super Fortress bombers that had force landed in Soviet territory, creating their own version, the Tu-4 by July, 1947. It is worthwhile to note the B-29 Super Fortress was one of the most complicated and sophisticated machines in existence at the time. This project demonstrates a highly complex and sophisticated machine, can be reverse-engineered, if a miscreant has access to one or more physical examples.



Figure 8 – B-29 Super Fortress or Tu-4? Photo credit: John Sloan (JohnS426@AOL.com), courtesy of Aeroweb of Italy.

Publishing and broadly distributing large numbers of 3-D models suggests the possibility of giving miscreants the complete design of a company's product on a disk or via the internet, ready for supporting reverse-engineering projects. Fortunately, there are techniques available for greatly increasing the time and expense needed to reverse-engineer from 3-D models. Effective application of the techniques described in this paper can make a reasonable and economically rational miscreant decide it is more cost effective to reverse-engineer from physical examples than from 3-D models.

Again, this paper's author is not a lawyer. Seek legal advice and review of any plans for protecting IP and the 3-D models to be distributed and published.

REASONS FOR PUBLISHING 3-D MODELS

In 1927, Fred R. Barnard seems to have originated the phrase, "A picture is worth a thousand words!" in an advertisement promoting the use of advertising on streetcars.²

Advertising copy or ancient Chinese proverb, the meaning of this phrase is generally acknowledged to be true. Shapes, dimensions and similar information can be communicated more quickly, with great clarity and economy via pictures than with words. If two-dimensional images are efficient in communicating, three-dimensional models yield even greater speed, clarity and economy of communication.

A major communications company, Adobe Corporation, includes the capability to view 3-D models and animations as a standard feature in their ubiquitous document viewer, Acrobat Reader. This development seems to be a clear indication of 3-D models being ready for use in mainstream communications. There are numerous suppliers of 3-D model creation and animation & documentation authoring, management and viewing technology. Suppliers encountered during project work include, but are not limited to: 3dvia, Adobe, Anark, Autodesk, Enigma, Immersive Design, Lattice Technology, nGRAIN, Oracle, Parallel Graphics, Parametric Technology Corporation, Right Hemisphere and Siemens.



Figure 9 – Example Acrobat 3-D Document

With 3-D "thumbnail" model file sizes as small as tens of kilobytes and 3-D animated model file sizes in the several hundred kilobytes through tens of megabytes, 3-D models are now worth evaluating for use in many applications. Previously restricted to engineering and manufacturing applications, 3-D models are now found in: advertising communications, product configuration applications, parts catalogs, and service information. Service information applications include: adjustment procedures, remove and replace procedures, diagnostic procedures, theory of operation stories and training materials, including self study courses and distance learning modules.