



## Integrated solutions for freeform modeling and inspection

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Imageware™, a Unigraphics product

- Design, accurately build, and fully inspect high-quality freeform products in less time than you ever thought possible.



### **Bringing better products to market in record time**

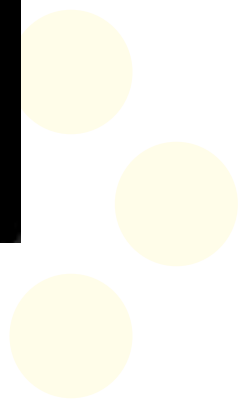
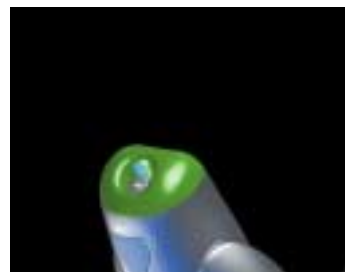
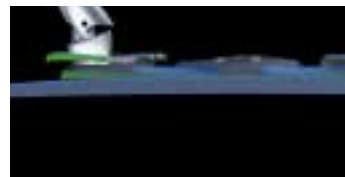
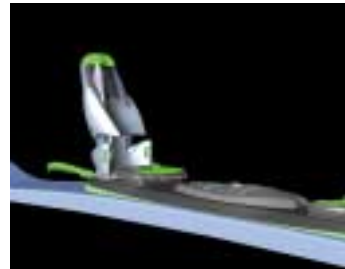
In today's highly competitive business world, time is of the essence. As competition increases, there is a growing need to substantially reduce development cycle time to get products to market faster without sacrificing quality. Design-through-manufacturing capabilities that can be used throughout an extended enterprise are being embraced by companies of all sizes looking to leverage strategic partnerships and to stay one step ahead of the competition. As manufacturing and business challenges increase and expand, designers and engineers are demanding the most accurate, reliable and efficient tools available. They expect tools that fulfill high-quality modeling requirements where users can creatively explore their design ideas while working with complex 3D forms in an intuitive environment that requires only a minimal investment of time and resources. With these tools, companies can expedite production-level models by quickly and accurately turning conceptual ideas into aesthetically pleasing, precision models.

In addition to complex surface development capabilities, users require the ability to validate their product designs with effective diagnostic and evaluation tools to visually interrogate model quality throughout the entire design process. Users also require an open and interactive environment where designers and product engineers can collaborate, explore different design themes, capture true design intent, and build/evaluate models for production.

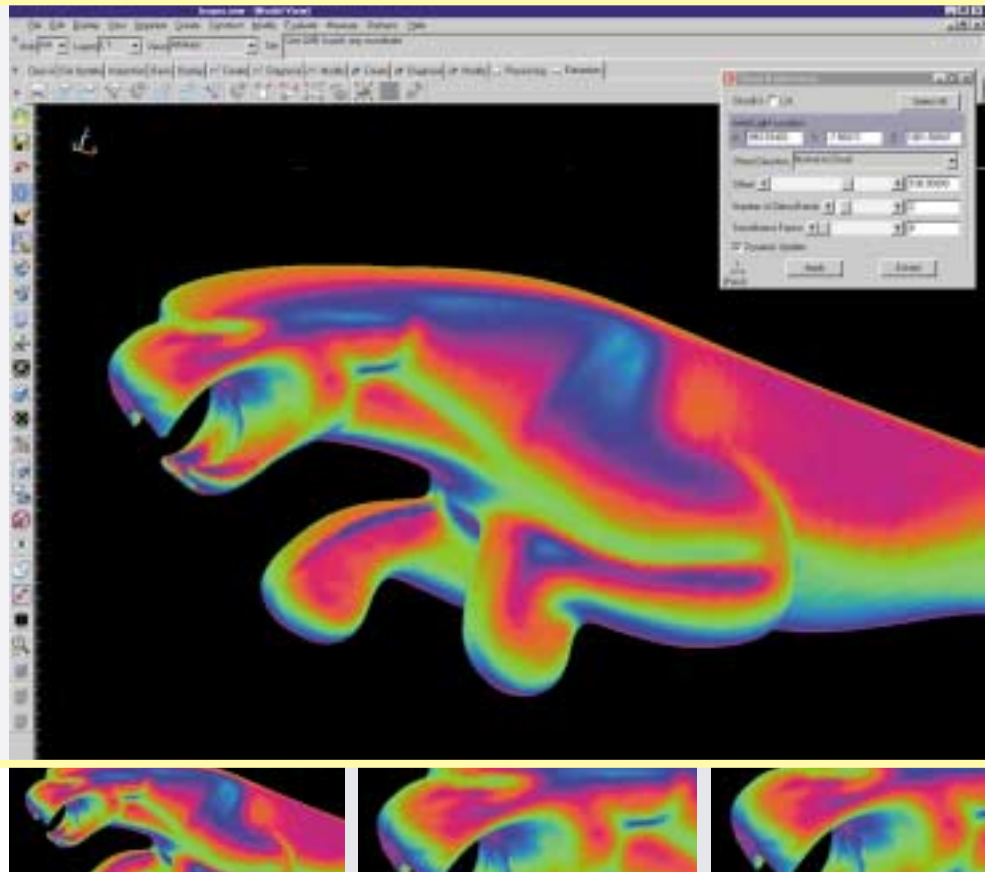
## Introducing Imageware, a Unigraphics product

Imageware has forged new ground in freeform modeling technology, providing a unique and comprehensive approach to 3D modeling and inspection for every stage of product design – from early concept to production-quality surfacing, to full 3D part inspection for downstream engineering and manufacturing applications. Imageware brings advanced modeling technology and the passion for innovation to the broad-based design, reverse engineering, and styling markets. The result is a solution that accelerates design, engineering, and manufacturing to new levels of integration, speed, and efficiency. Imageware allows you to freely and intuitively create, and rapidly explore and evaluate shape design in 3D. Developed with specific industries in mind, Imageware offers direct data exchange capabilities and standard 3D CAD interfaces that allow easy integration into any environment.

Optimized for complex freeform design, Imageware promotes the development of superior ergonomic and aesthetically pleasing product shapes – utilizing hybrid modeling techniques to design for manufacture. Whether working to capture a physical model's design intent, rapidly create surfaces for downstream applications like FEA or CAE, create and perfect high-quality production surfaces, or inspect geometric quality and accuracy, Imageware is used by artists, designers, and engineers to meet rigorous freeform modeling demands.



⚡ Limited only by your imagination



Imageware is an intuitive, process-driven modeling tool that dramatically decreases time to market while increasing profitability. What's more, Imageware is so exceptionally easy to use that designers are limited only by their own imaginations. For more than 10 years, Imageware has focused on the following product development application areas.

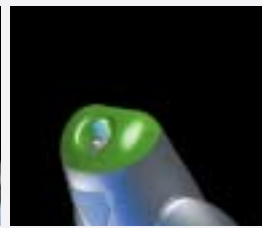
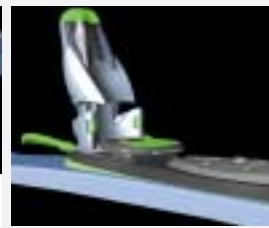
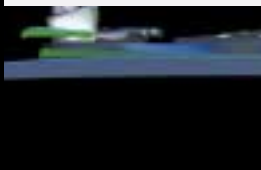
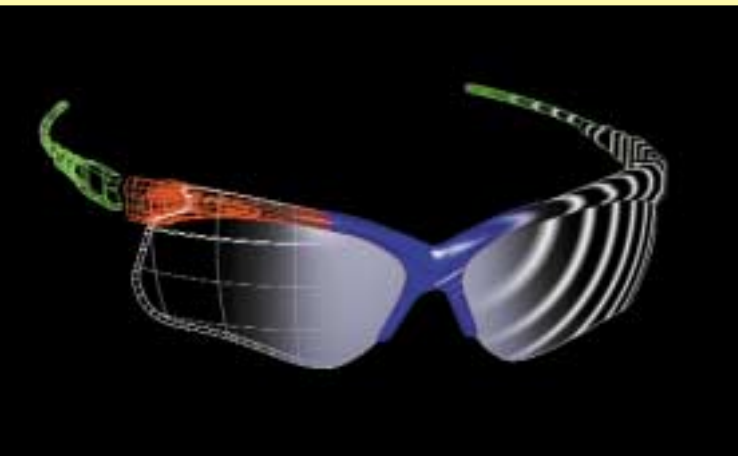
#### Advanced modeling

Advanced modeling capabilities provide a consistent design workflow with maximum control for checking model aesthetics, fidelity, and surface smoothness. With the intuitive modeling creation tools, you can create freeform geometry from curves, surfaces, or measured data. Dynamic surface modification tools allow design changes to be explored interactively to immediately visualize the aesthetic and engineering implications of the design. Use of the real-time diagnostic tools provides full analysis – visual and analytical –

of the quality of geometry prior to manufacture, thus eliminating the need for error-prone guess work. These tools are instrumental in identifying surface curvature and highlights used in detecting surface flaws, deviations, and imperfections. Efficient continuity management tools maintain surface-to-surface transitions for perfecting even the toughest Class A model. Together, with fully associative surfacing functions, you will realize a massive acceleration in productivity whether performing feasibility design studies on freeform models, or creating production quality surfaces.

#### Reverse engineering

Reverse engineering capabilities allow designers, engineers, and tooling craftsmen to use input from physical components at every stage of the design-to-manufacturing process. This approach not only allows for accurate design representation and rapid comparisons of physical legacy data, but also bridges the physical-



to-digital environments. Geometric representation can be created in a fraction of the time of conventional CAD systems. Imageware allows physical parts with no CAD description to be brought into any CAD/CAM system for subsequent design and analysis. Geometry can also be used within a simulation environment to ensure feasibility at various stages of the product lifecycle.

#### Computer-aided inspection

Imageware's inspection capabilities provide full 3D CAD-to-part verification for first article quality with complete and accurate analysis. Inspect any complex nominal CAD geometry to the actual physical representation and eliminate the need for manual and/or 2D methods. Imageware Inspection outputs graphical color comparison plots that simplify communication of 3D inspection results. Powerful alignment and registration tools eliminate the need for multiple inspection iterations. You can also

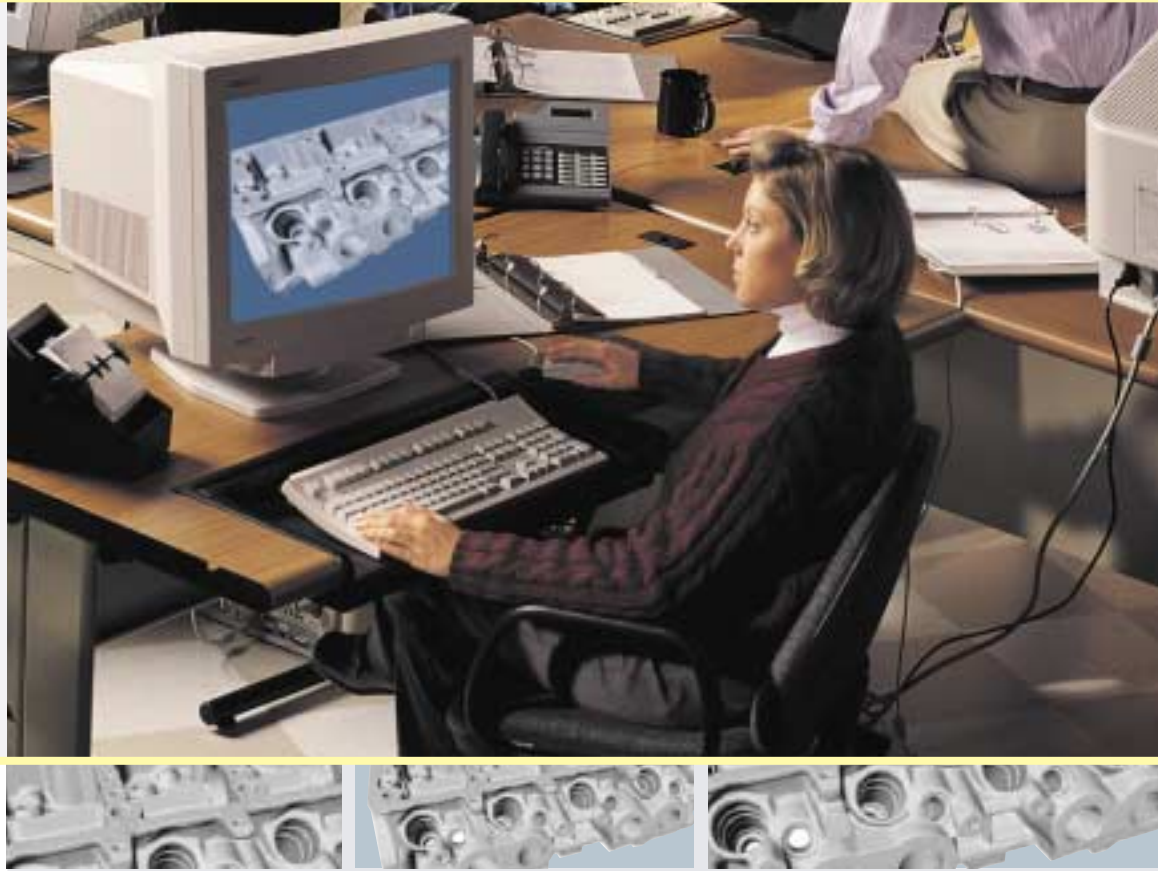
store, track, and manage inspection records electronically from within an Imageware environment.

#### Polygonal modeling

Imageware provides a comprehensive set of model repair, prismatic feature construction, and point/STL data processing tools for rapid prototyping applications. These tools help product engineering transfer design intent into production in a reliable and efficient manner. The polygon-based creation, visualization, modification, boolean, and basic mold tools enable you to effectively reuse data from multiple sources for further refining product design.

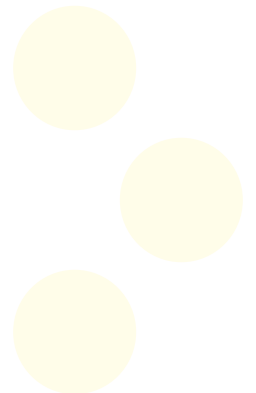


## Experience the Imageware advantage



### Workflow for the entire creative process

As many companies move to 3D design techniques, stylists and designers alike recognize the importance and ease of transitioning from 2D to 3D. The inherent ability to quickly turn concept ideas into an accurate surface model is critical to the success of product design. While 2D methods have proven successful in building products for centuries, new, more productive 3D methods and practices now complement the existing 2D-design process by maintaining and representing design intent. With these 3D methods and practices, companies are establishing new standards for shorter design cycle times, improved product quality, and lower costs. Whether working a new design, a physical model, or a re-engineered part, Imageware provides a means for extending creative workflow while utilizing familiar modeling tools.



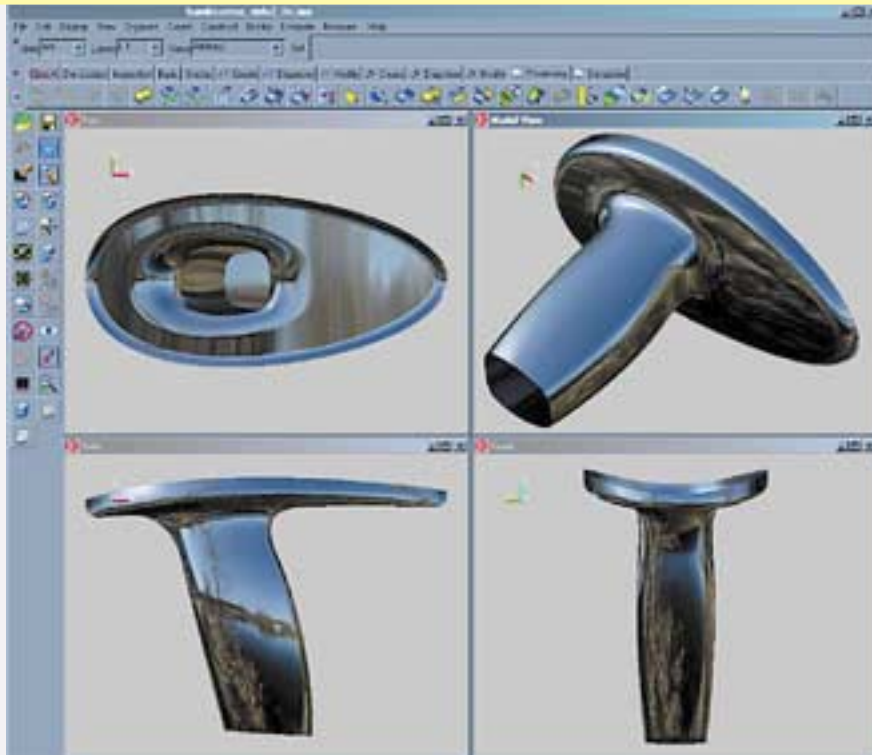


### Improving product communication effectively

Product definitions captured in 3D provide superior communication of design intent, not only among designers and stylists, but also throughout the engineering and manufacturing environments, the extended enterprise, and the supply chain. With Imageware, you can dynamically explore different designs on-screen to immediately see the aesthetic and engineering implications while working out a design solution. Being able to communicate critical design issues early in the design process can lead to the dramatic reduction of and need for physical models. With full-color 3D diagnostics and plots that update in real-time, communicating design changes and modifications as the design model is manipulated is an easy task. Further speeding the development effort are

the extended visualization tools and reporting capabilities. You can evaluate the aesthetic properties of designs using customized environment maps, or if inspection is required, you can evaluate and output detailed analytical results for comparison.





### Constraint-based modeling

With Imageware, simplifying complex design work is made easy by using the constraint-based modeling paradigm. This methodology allows designers to work in an interactive environment and make critical design decisions in the early stages of product development.

Imageware's 3D constraint engine enables associative modeling that can dramatically change the way you create surfaces for Class A and high-quality modeling tasks. The tools have been designed so the user can decide when, where, and for how long a constraint condition is needed without increasing model size or sacrificing performance. By capturing constraints as you work, all design changes are reflected in real-time, which allows you to evaluate different designs without requiring excessive planning at the outset or tedious rework that is typical of non-constraint based systems.

Color coding highlights the master and slave relationships which can be quickly and easily inverted. Constraint symbols appear on curves as they are created to indicate the type of continuity present.

In addition to constraints, inherent associativities are captured with several entity creation commands. Associativities such as these give you the

power to maintain certain characteristics while modifying and editing data. Features with associative properties include loft, sweep surface, fillet, flange, curve offset, and extrusion.

### Extending curve-based modeling

Both new and enhanced commands have been added to provide a more complete set of curve creation functionality for curve-based surface development, which is extremely important for high-quality and Class A surfacing tasks.

The new features reduce the repetition often required for creating families of curves, while infinite construction line and plane capabilities aid in the accurate creation of new geometry. Infinite construction elements are also relied on as aids for snipping and intersection operations. Other tools, such as an infinite workplane, have been added to benefit common modeling operations. This workplane can serve as a sketch plane or can be used to intersect surfaces and curves.



## ⚙️ Dynamically edit your models



### System-wide evaluation tools

Curvature and surface evaluation tools provide real-time feedback that allows you to create better curves and surfaces from the start, resulting in higher quality surfaces created in less time. Combine the detailed feedback from these tools with Imageware's many modification tools and you can easily evaluate and dynamically edit your models in the current view to correct problem areas.

Several new curvature evaluation tools have been added along with many enhancements to an already powerful set of existing diagnostic tools.

Overall enhancements to existing tools include:

- live updates of needle plots as you rotate and translate
- options for view-dependent and direction-dependent curvature evaluation
- additional curve sampling options
- ability to evaluate surface flow on multiple surfaces
- ability to evaluate curvature flow over multiple surfaces and in a given direction
- capability to easily identify inflections for patch break points

Specific new diagnostic commands and major enhancements include the following:

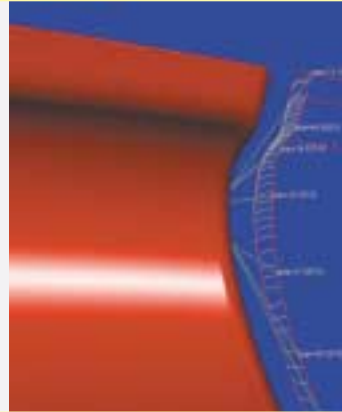
### Realistic environment mapping

With increased performance and greater interaction for environment mapping, including the option to select user-defined environment maps, you can evaluate the aesthetic properties of surfaces with ease and variety. For convenience, a number of additional predefined environment maps are provided. Environment mapping is used by Class A designers to accurately represent a completed model as though it were in a realistic environment – allowing for accurate highlights and reflections.



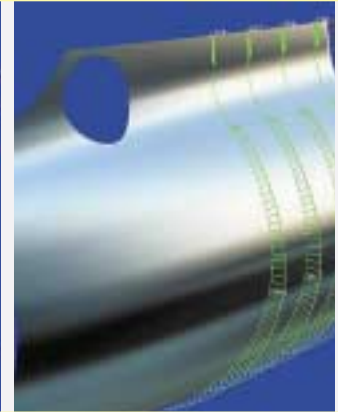
#### **Two-color zebra plots**

You can diagnose surface flow and view surface shape and quality with zebra plots. Zebra plots, which ray trace stripes onto all visible shaded surfaces, provide yet another method for identifying surface flaws.



#### **Surface gap/angle plots**

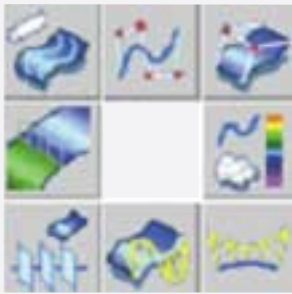
To perform checks on surface features such as offsets and panel shut gaps, you can now display the angle and gap between neighboring surface boundaries. The angle check evaluates the surfaces to highlight defects which lead to poor visual appearance on fillets or other geometry.



#### **Point, curve, and surface deviation plots**

The capability to calculate and display multiple deviation measurements allows you to compare the effects of different design iterations on your data. Deviations between a curve, a point, or a surface can be calculated and plotted – the reported distance depends on the component and the calculation options. Toggles are also provided for selectively displaying and hiding the needle plot and/or actual displacement value.

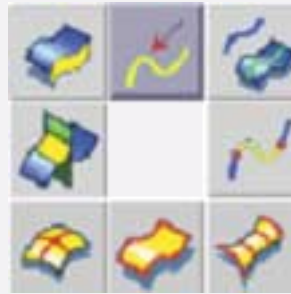




Create



Modify



Diagnose

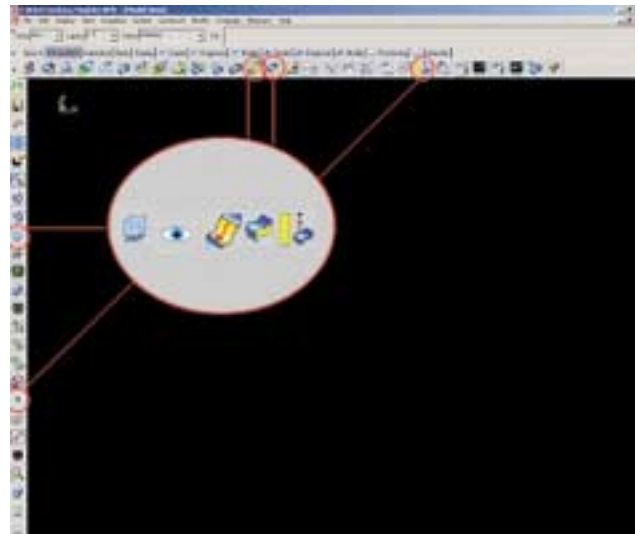
### Streamlined, intuitive workflow

New functional menu groupings have been implemented throughout the interface to more closely reflect how you work, allowing both beginners and experienced users to quickly feel comfortable with Imgeware commands. Similar commands, such as system preferences, are conveniently placed in one location for quicker access.

Carefully redesigned icons complement the new look and feel while the consistent color scheme, styling, and graphics used make the icons quickly recognizable by all users.

### Extending hot key capabilities

Rapid access to selected creation, modification, and diagnostic commands are now accessible through 'floating tool shelves'. A floating tool shelf is enabled via simple key combinations to put more functionality at your finger tips when you need it. Floating tool shelves appear in the viewport for quick access to key commands, and can be interactively positioned by the user.



## Imageware offers scalable solutions



Imageware provides application-driven solutions throughout all aspects of freeform product design. This unprecedented technology enables customers to design, reverse engineer, accurately build, and fully inspect high-quality, freeform products in less time. Recent product releases and an increased focus on advanced surfacing, 3D inspection, reverse engineering, and polygon modeling have enabled an intuitive, flexible environment for product design, engineering, and manufacturing.

Designed to drive product quality and time to market, Imageware's modular-based product offering is scalable to meet customer requirements, encompassing the entire product development lifecycle – from conceptual design, prototyping, and inspection, through production manufacturing. For the first time, users can configure products that best fit their processes with tools critical to ensuring a successful product development cycle. Users can select from the following product offerings:



### Imageware Surfacing

Imageware Surfacing provides a powerful and intuitive set of curve and surface creation and editing functions for complex freeform shape design. This includes a host of surface creation commands for sweeping, lofting, and for developing complex shapes not possible in other CAD products. The creation tools are further extended with a set of functions for filleting, flanging, and surface offsetting. Essential to design is Imageware's ability to control curve character and surface flow by means of direct editing of control points. To complement the control point editing tools, a completely new 3D constraint solver for curve networks and an associativity framework (or real-time history solver) for surface creation operations has been implemented. These tools capture relationships between entities which result in more automated updates to geometry upon editing – improving the designers efficiency.

Imageware Surfacing also provides highly functional control for surface matching. This allows for continuity of neighboring surface patches at surface edges or to the interior of a surface for position, tangency, or curvature. Wide ranges of matching options are available providing the ultimate control of 3D geometry. In some instances, design requires the use of Bezier models (automotive Class A production quality surfaces) that utilize higher order geometry. Imageware Surfacing enables up to order 21 (surfaces) and ensures that the design, engineering, and manufacturing criteria are respected throughout the surfacing process.



### Imageware Inspection

Imageware Inspection is aimed at metrology and 3D inspection of complex digital shapes. It provides versatile and easy-to-use 3D data analysis for comparing physical measured components to nominal CAD data. Users can import reference data or discrete 3D coordinate measurements from physical parts and directly compare measured points to surfaces, points to points, or points to STL data. The data can be automatically oriented and aligned for the greatest possible accuracy required. Once aligned, a host of capabilities compare the qualitative and numerical differences between the component part and scan. GD&T capability is provided for point clouds along with a range of annotation tools for documentation and reporting.

Comparison results are reported in color-coded deviation maps, both graphical and textural. These color maps provide a strong visual cue pinpointing the main sources of error and the trends of deviation over the entire part. The ability to visualize design and manufacture concerns prior to tooling commitment drives dramatic reduction in time to manufacturing. Additionally, analysis query functions provide detailed numerical reports for selected measurement points or localized regions that can be used to globally communicate critical manufacturing information.

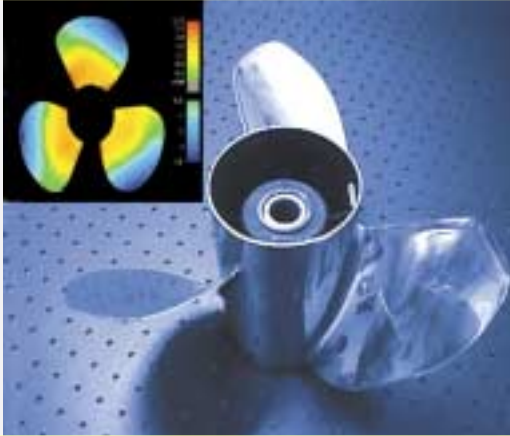
### Imageware Evaluation

Imageware Evaluation contains tools for assessing overall product quality through visual and mathematic evaluation. Efficient continuity management tools maintain relationships between entities for positional, tangent, and curvature conditions as well as deviation checking tools to evaluate precise differences between entities. This eliminates tedious manual work while maintaining the natural, creative workflow.

Real-time diagnostic tools provide immediate analysis of the quality of geometry for manufacture – emphasizing the aesthetic qualities of a component model. Environment and texture mapping are extensively used to predict, visualize, and reflect realistic testing scenarios, essentially reducing or eliminating the need for expensive physical models or prototypes. These tools are instrumental in visually identifying surface flow properties and highlights used to detect surface flaws, deviations, and imperfections. Additionally, validation tools include checking for machining capability, parting lines, and surface gaps – useful in identifying design flaws before data is released for downstream processes.

Imageware Evaluation is an ideal complement to an existing mechanical CAD installation, providing tools to satisfy a very high level of quality and craftsmanship. Models from the native system can be transferred into Imageware to fully evaluate and interrogate overall model quality. This effectively extends functional capability, enhancing the performance and time to market development cycle.





### Imageware Polygon Modeling

Imageware Polygon Modeling is focused on conceptual product design and provides a suite of tools for working with tessellated or triangulated data. With the ability to work from stereo-lithography (SLA), finite element analysis (FEA), or VRML data, users can provide direct input to downstream applications for initial feasibility studies. Imageware Polygon Modeling is ideal for rapid packaging analysis – dramatically reducing the current process which typically requires long-lead times for reverse engineering of Nurb surfaces.

Enhanced polygon modeling functionality includes creating polygons from cloud data, offsetting polygons for use in packaging, and cutting cross sections through polygon data – used for engineering feasibility and surface layout. For rapid prototyping preparation and build testing, users can repair polygon meshes by filling holes to create a water-tight model and to add or subtract polygon data through Boolean operations. In concept development, interactive polygon sculpting and editing tools exist to allow users the flexibility to quickly shape and form rapid models. At any step along the process, users can utilize the extensive polygon visualization tools to further review and evaluate all aspects of the model – and all in real-time.

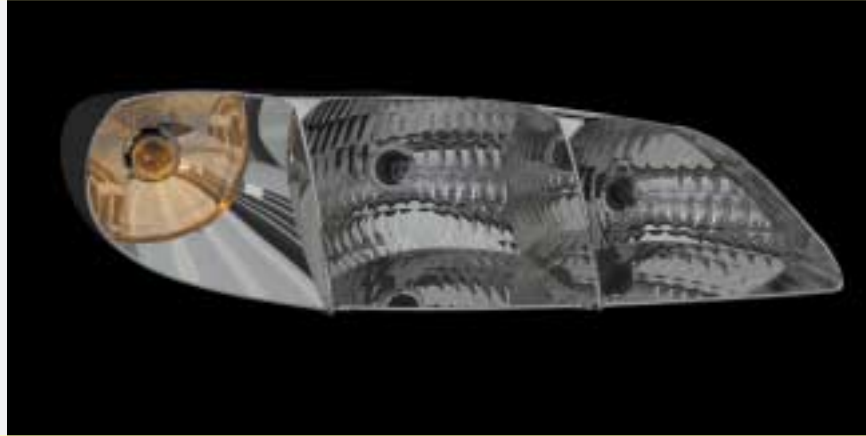
### Imageware Point Processing

Imageware Point Processing contains tools for evaluating and manipulating collected or measured point data. Imageware accepts data from most optical (camera) scanners, coordinate measuring (CMM) systems, laser scanners, X-ray scanners, and finite element analysis results – without placing limits on point count or file size. The manipulation of point data is typically the first task for reverse engineering or inspection, so it is important for users to have complete freedom to choose from a number of tools to inspect, modify, and clean up the measured data.

Users can sort, order, and arrange collected data in the most suitable fashion for downstream use. Point display, sample density, and visualization of the data are only a mouse-click away and at user discretion. Multiple scan datasets can be combined as one, then cut, trimmed, or modified for specific data setup. A unique benefit of working with collected data is that the user is in full control over what gets created, and when, where, and how it is used. Cross sections can be created automatically or specified, interactively, by the user. Additional functionality like global modeling of collected data (for offsetting) exists to aid users in up-front feasibility studies.

With more than 10 years experience in the point processing field, Imageware has proven product maturity with robust capabilities optimized especially for handling true design capture and for working with massive dataset collection.

## ⚙️ Maintaining data compatibility



Imageware provides a seamless CAD neutral exchange of data between leading CAD systems and the native Imageware file format that enables digital design to be maintained throughout the entire product lifecycle. These interfaces remove many of the potential errors caused by different interpretations of other standard file formats by providing tuned, direct data exchange. Designers and engineers can concentrate on what is most important – getting their job done – not on worrying about potential data loss.

### **Imageware/Unigraphics databridge**

Exchange data using the Unigraphics parasolids transmit file “.xmt\_txt.” Surfaces are translated with this databridge. Additionally, data exchanged through the parasolids format is interoperable with Solid Edge®, and provides an up-front freeform modeling solution.

### **Imageware/CATIA databridge**

Exchange data using native CATIA “.model” and “.exp” file formats. Data exchange is more flexible than ever because it runs independent of the CATIA installation.

### **Imageware/Pro/E databridge**

Read and write Imageware “.imw” format files from within the Pro/E product. By adding menus into the user’s existing Pro/E installation and using Pro/E open architecture, the Imageware file can be created and read.

### **Imageware/I-deas® freeform feature**

Create a seamless workflow between flexible freeform design and styling with proven part design and data management. Track product design data through an I-deas part with product history and managed/archive data through the use of standard I-deas Team Data Management paradigms.

## About EDS

EDS, the leading global services company, provides strategy, implementation and hosting for clients managing the business and technology complexities of the digital economy. EDS brings together the world's best technologies to address critical client business imperatives. It helps clients eliminate boundaries, collaborate in new ways, establish their customers' trust and continuously seek improvement. EDS, with its management consulting subsidiary, A.T. Kearney, serves the world's leading companies and governments in 60 countries. EDS reported revenues of \$21.5 billion in 2001. The company's stock is traded on the New York Stock Exchange (NYSE: EDS) and the London Stock Exchange. Learn more at [eds.com](http://eds.com).

## About product lifecycle management solutions

EDS is the market leader in product lifecycle management (PLM), providing solutions to the global 1000. Product lifecycle management enables all the people who participate in a manufacturer's product lifecycle to work in concert to develop, deliver, and support best-in-class products. As the only single-source provider of PLM software and services, EDS can transform the product lifecycle process into true competitive advantage, delivering leadership improvements in product innovation, quality, time to market, and end-customer value.

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