Rhino**ceros**®

NURBS MODELING

PRECISE . COMPLEX . ADVANCED . FREE FORM SURFACE MODELING

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Rhinoceros®

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SubD

SubD

S P A R K

SPARK

Overview
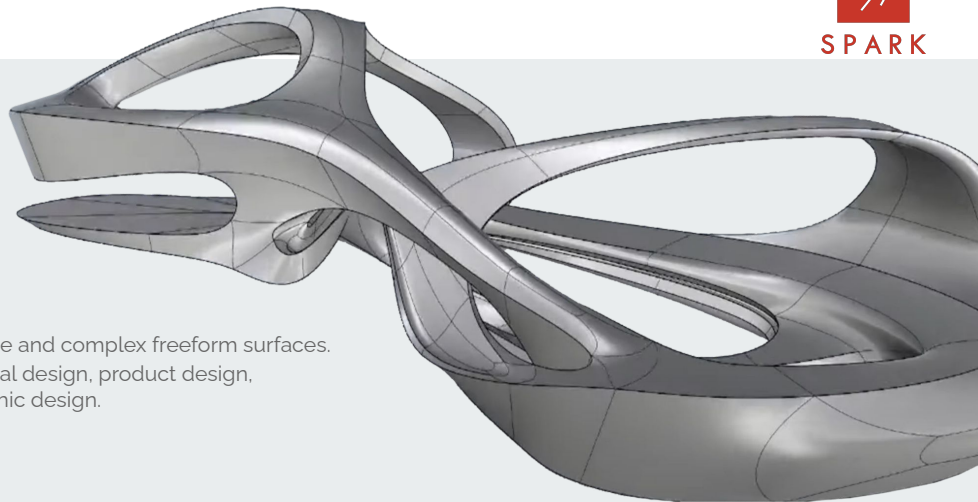
What is Rhino3D?

Rhino, also known as Rhinoceros or Rhino3D, is a CAD program used to create advance and complex freeform surfaces.
A versatile program used across a variety of industries, including: architecture, industrial design, product design, automotive and watercraft design, jewelry design, as well as for multimedia and graphic design.

CAD modeling generally falls under 3 main types:

1) Solid modeling - Solidworks, OnShape
2) Wireframe modeling - Blender, Maya
3) Freeform (or Direct) modeling - Rhino, Alias, Catia (ICEM Surf)

Freeform surface modeling is a more advanced technique that relies on guiding lines to define the curvature or shape of the part. This allows users to create shapes that are more advanced, artistic, or organic than can be achieved using a solid or wireframe modeler. Freeform modeling allows you to manipulate the geometry to form whatever you envision and doesn't just rely on set geometric shapes.

This is valuable in industries such as airplane design or automotive applications where complex curvatures are needed to achieve desired performance. Or artistic industries like jewelry design or product design where styling and aesthetics are important.

Rhino can be used in conjunction with other CAD packages (such as SolidWorks, OnShape, etc.) to create fully realized engineered part designs.

Key Capabilities

### Model quickly without constraints.

Rhino allows us the ability to interface ideas, progress through solutions, and confirm design intent quickly and effectively.

SubD Capabilities (Subdivision Modeling).

A key benefit of this is the ability to quickly explore and iterate complex, highly accurate, free-form shapes and explore multiple design options. Also a powerful tool to convert scan or mesh data into SubD objects then optionally to NURBS.

Working with Mesh Data (STL)

Rhino has a robust suite of mesh tools. This is especially important working with data from 3D scanners. Polygon meshes are also used to represent geometry for rendering, animation, stereolithography, visualization, and FEA.
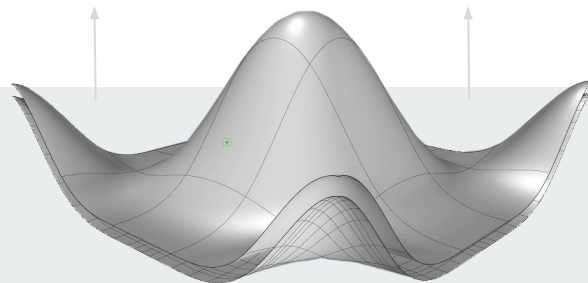
Fixing bad geometry (iges, etc.)

Rhino can be used to clean up poorly written IGES files. Rhino will read in as much valid information from a model as it can, skipping corrupt objects, but reading all the points, curves, and surfaces. Rhino will often read the file and fix the problems automatically.

Rendering & Graphics.

Rhino comes with the powerful Rhino Render raytracing engine built in. It is also compatible with most industry-leading visualization tools.

Works well with other CAD packages

Versatility in File Formats: Rhino has the ability to import and export files in a wide range of formats, which makes working with other software, systems, and users much easier.

Rhino is a a very versatile software package; it is used in architecture, jewelry and object design, engineering, automotive design, prototyping, and even graphic design.

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Efficient & Quick

Rhino's ability to quickly model both simple and complex shapes make it a very power design tool.

Rhino allows us the ability to interface ideas, progress through solutions, and confirm design intent quickly and effectively.

Using Freeform modeling, the design process is unconstrained. Freeform/Direct modeling creates geometry rather than features. This supports the initial conceptual effort where the designer doesn't have to be tied down with features and their inter-dependencies or the impact that making a change might have. Rather than focusing on building a fully constrained model, we have the ability to quickly model and iterate in much less time. This is especially valuable in the initial form exploration phase where the design is not quite sorted out yet. Less time is spent worrying about features, constraints, and original design intent and more on shape and form.

Shape Exploration
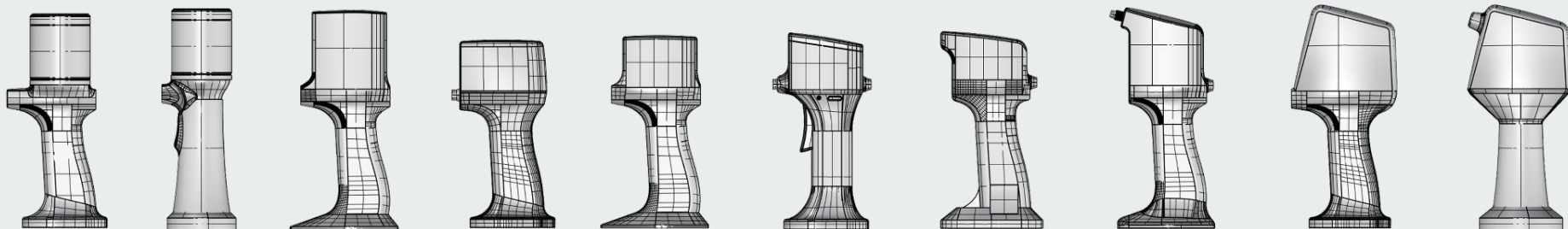
Rhino is much faster at the beginning of the design phase to quickly explore and iterate without constraint.

Sub D

Designers are often tasked to create shapes that mimic organic objects with flowing lines and curves. Creating these types of shapes with a parametric modeler can be quite challenging and require a different approach. This is where SubD comes in.

Detailed and complex forms can be easily created with Sub-D, allowing for the generation of amorphous surfaces. It offers a practical and fast modeling capability, which makes it a valuable tool for organic surface designs.

Explore organic shapes quickly.

In industrial design the design process involves exploring different concepts and refining them until the final product is reached. SubD's capability to quickly explore and iterate on multiple design options in real time makes it invaluable.

Highly Accurate and Precise.

Rhino SubD generates high precision spline based surfaces and thus introduces a level of accuracy to the process of creating complex freeform shapes. As with Rhino NURBS objects, they provide a continuous description of curve geometry. This gets over one of the major criticisms of mesh based SubD workflows that are often regarded as being approximate.

SubD objects are highly accurate and can be converted directly to manufacturable surfaces and solids.

Additionally, scan or mesh data can be converted into SubD objects, then optionally to NURBS.
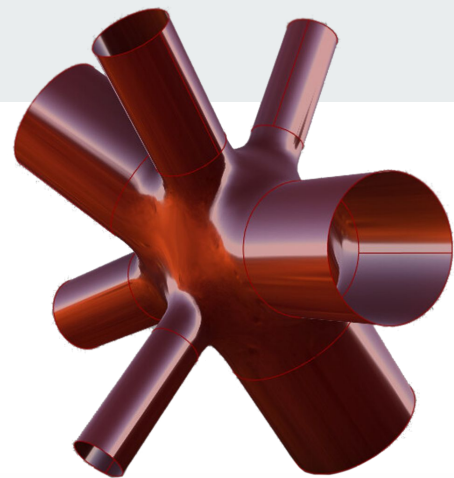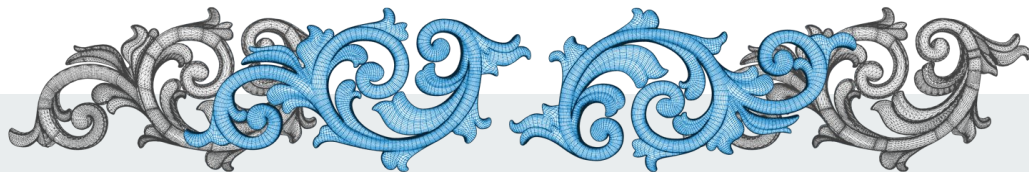
Mesh Tools, Scan Data, & Reverse Engineering

3D Printing
3D Printers require a mesh rather than a NURBS surface or polysurface. 3D printers can be quite fussy when it comes to the quality of the mesh, which need to be closed with no holes and no extra faces present. Rhino provides tools to analyze NURBS objects and meshes to find problems and fix them.

3D Scanning
Meshes are also the main output of all 3D scanners. Rhino is able to import the scan data, which is then used as reference geometry for the reverse engineering process.

Rendering
Some graphics hardware render only meshes. That is, the render software won't use a surface or polysurface directly. Rhino can generate a mesh with detailed control over resolutions, which can then be passed off to the rendering software.

Importing Mesh Files
Rhino has the ability to read in mesh files exported as an STL, OBJ, PLY mesh or PTX point cloud.

Reverse engineering is a process that involves measuring a physical object and reconstructing it as a 3D model to recover the design intent.

- With the aid of 3d party plugins, Rhino is the perfect tool for reverse engineering from scan data.

- Allows the user to maintain control over their work with accurate deviation control and visualization. This ensures accuracy and maintains design intent.

- Ability to create complex hybrid 3D models using part scan data mesh and CAD engineering features.

Fixing neutral files such as IGES and STEP

Rhino's basic tools can be used to correct IGES files:
- Improperly formatted IGES files
- Missing or duplicate surfaces
- Gaps or overlaps
- Bad surface trimming information

This includes correcting files that do not read properly into SolidWorks..
- In most cases, most of the data can be salvaged in the IGES file.
  Rhino reads in as much information as it can from the model, skipping corrupt objects.
  By reading in all the points, curves, and surfaces it can replace missing surfaces, fix bad trims, fix surface discontinuities, and export a solid model for SolidWorks.

- If the problems are too extreme, remodeling may be the best fix. In this case, Rhino contains the tools to harvest isoparms, sections, and edge curves. All crucial to preserving the design intent when remodeling.
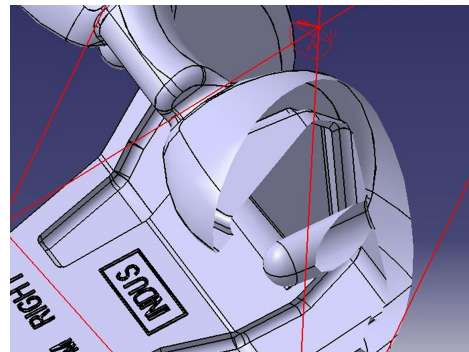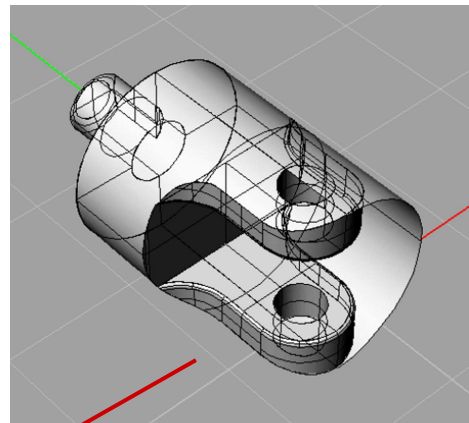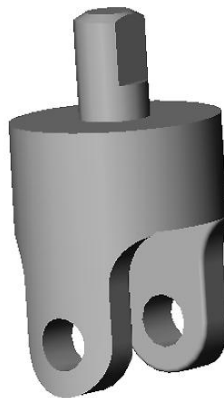
Combining Rhino's capabilities with a solid modeler, like SolidWorks, benefits the entire 3D modeling workflow. This gives users the ability to repair IGES files, translate files, create accurately complex surfaces, and use data from a variety of sources.

Rendering & Graphics

Rhino can quickly and efficiently create beautiful images.
- A valuable tool in presenting the creative vision and getting "buy-in" from clients, customers, collaborators, investors, or the public.
- No need to export to additional software for an efficient workflow.

Rhino has a built-in, extensive library of materials, advanced lighting, and camera controls.
- Built in powerful Rhino Render raytracing engine.
- Presentation tools like rendered display modes, gradients, hatches, physically based materials and more.

Rhino is compatible with industry-leading visualization tools:

ENSCAPE™ octane Maxwell V-Ray Twinmotion bella

THEA RENDER KeyShot Maverick FluidRay D5 RENDER Iray

PRODUCT PHOTO

PRODUCT RENDER

Compatibility with Other CAD Programs

Direct and Parametric workflow:

By using a combination of parametric and direct 3D modeling, we can maximize innovation while at the same time ensuring speed, flexibility, and faster time-to-market. Direct modeling creates geometry rather than features so it supports the initial conceptual effort when shape forms are being explored.

During the conceptual thinking phase, a direct modeling workflow allows for quick manipulation and form iteration. This method focuses on the impact a change has on the overall model rather than specific features and their inter-dependencies.

During the detailed design phase, when most of the Blue Sky thinking and exploring is finished, we can then import the model into a parametric modeling package (such as SolidWorks or OnShape). From there the exact features, requirements, and manufacturing criteria can be modeled.
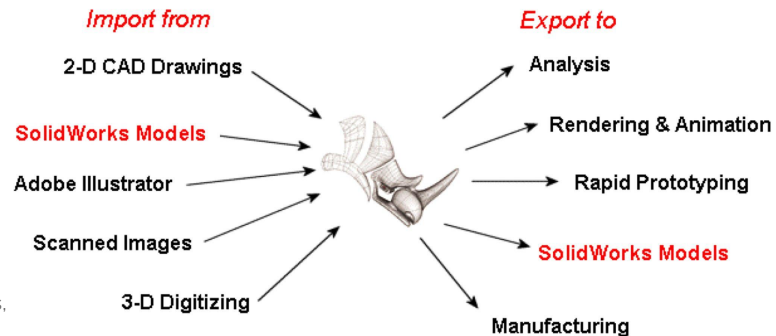
SolidWorks:
As previously highlighted, Rhino can enhance the modeling features of SolidWorks in several key ways:

- Fix "bad" IGES files
- Create advanced, free-form surfaces for import that can be used as body features, reference geometry, or trimming surfaces.
- Translate 3-D data between applications
- Edit 3-D data from diverse sources

Versatility in File Formats:

The ability to import and export files in a wide range of formats makes working with other software, systems, and users much easier, From Inventor, to AutoCAD, to Solidworks, and more.

Some of these include, but are not limited to: STL, OBJ, DWG, SLDPART, SLDASM, IGES, and STEP.

Import from

2-D CAD Drawings
SolidWorks Models
Adobe Illustrator
Scanned Images
3-D Digitizing

Export to

Analysis
Rendering & Animation
Rapid Prototyping
SolidWorks Models
Manufacturing

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More than a 3D CAD modeler

Rhino may be best known for its ability to model complex freeform surfaces with precision and accuracy.
A different modeling approach than wireframe or solid modeling that allows the user to create more advanced, artistic, and organic shapes.

But, this 3D CAD program offers so much *more* than that:
- Quickly and efficiently model shape iterations, including SubD capabilities
- Work with mesh data
- Rendering and graphics

What really makes Rhino a powerful tool though is it's unique ability to complement other 3D modelers. Properly wielded, Rhino can be a crucial part of the design process that improves the *overall* Workflow.:

- Fixing bad geometry (iges, etc.) that includes files unreadable to SolidWorks.
- Ability to import and export many file types.