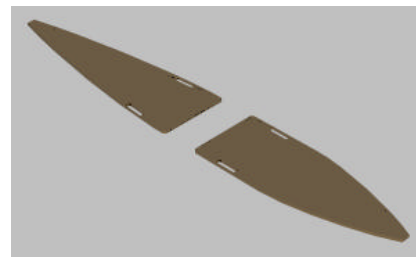


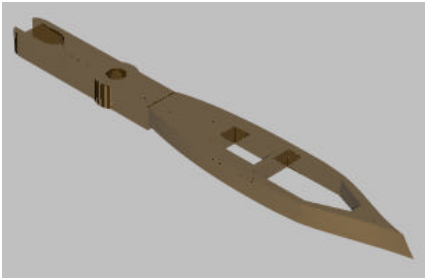
The appearance of two new versions of *Twenty Thousand Leagues Under the Sea* on television last spring rekindled my old interest in the Jules Verne classic. Over the next few months I read two different versions of the book, and watched the 1916 movie and my tape of the unsurpassed Disney film. In appreciation of the genius of that version, I decided to make a 3-D computer model of the *Nautilus*. I looked for film photographs in bookstores and in the library but found very few. I resorted to numerous captured frames from the video, trying to gather enough information to make the model. It was only after the model was nearly complete that I found Boz Adams' spectacular web page (www.20k.com) with all the pictures I could hope for, and got access to the *Nautilus* blue prints.

The completed model has several inaccuracies of scale and placement, mostly because the angles of the captured video screens obscured detail or distorted proportions. I corrected some of these but most had to remain. They really don't detract from the final effect. I constructed the model in *RayDream Studio 4*, relying on the Special F/X extension for important capability, later upgrading to version 5. I used *CorelDraw 4*, supported by *Micrografx Picture Publisher 5*, to do most of the graphic analysis. The *Nautilus* model is constructed from nearly 300 separate objects and consists of almost a quarter million triangles.

The model was built by combining sub-components, most of which were created using the *RayDream* free form modeler. The major component, and the first constructed, is the hull. I experimented with a number of versions before settling on this one. It has a single octagonal cross-section extruded within a symmetrical envelope. Both the cross-section and envelope were imported from *CorelDraw*. I added holes for the salon windows and some hatches using *RayDream's* boolean subtraction extension. To use the extension I generally made a temporary "cutter" object by sizing a cube or cylinder primitive and orienting it to cut out the hole I wanted. Boolean subtraction has been a most useful tool in the *RayDream* tool box. As built, the hull has much more internal complexity than needed, mostly artifacts from the construction process. Today, using the *Nautilus* blue prints, I would create a series of individual cross-sections and extrude a smooth skin over them.

Because they are difficult to see in the captured video, the side fins are perhaps the least accurate part of the model. They were created by vertically extruding a section with a built-in discontinuity for the side windows and holes for the diving planes. Today I would extrude one side fin lengthwise along a path using cross sections from the blue print, producing a much more accurate result. I would add the plane holes with boolean subtraction and duplicate a symmetrical copy for the other side.

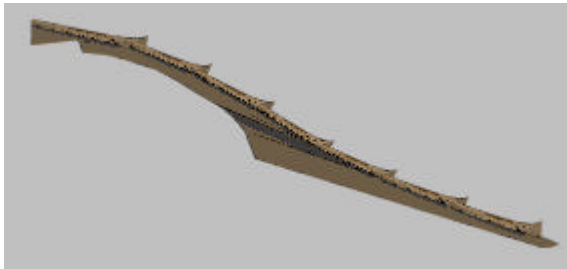
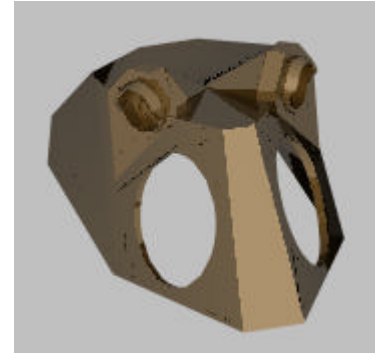




I constructed the deck using a similar extrusion technique. The separate stern portion is fairly simple linear extrusion, but the fore deck required different top and bottom sections. I used a simple rectangular block to fill the space under the pinnacle at the stern end.

The pilot house was the most difficult component to build. I originally made it as an extrusion of several sections, similar to the fore deck, but the result, perhaps because

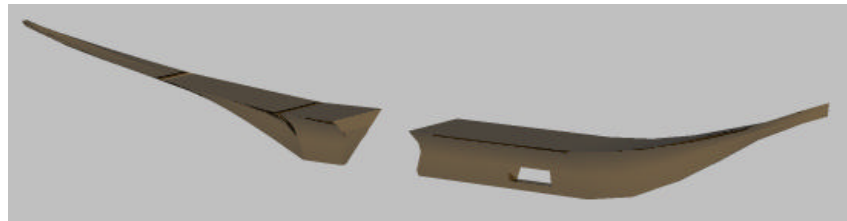
RayDream leans toward organic modeling, had several creases that ruined the flat sides. I finally resorted to *CAD-3D* and *CyberSculpt* on my old Atari ST. *CyberSculpt* permits manipulation of individual vertices, facilitating the creation of flat planes joined at angles. I wrote a quick and dirty program to convert the Atari file to a DXF and imported it for completion in *RayDream*. There I hollowed it out and cut windows by boolean subtraction. The new *RayDream Studio 5* includes a mesh form modeler that supports vertex editing so the extra steps should no longer be necessary. I made the eye in similar fashion and duplicated the finished assembly for the other side. The image shown here consists of at least nine objects including the two separate eye assemblies.



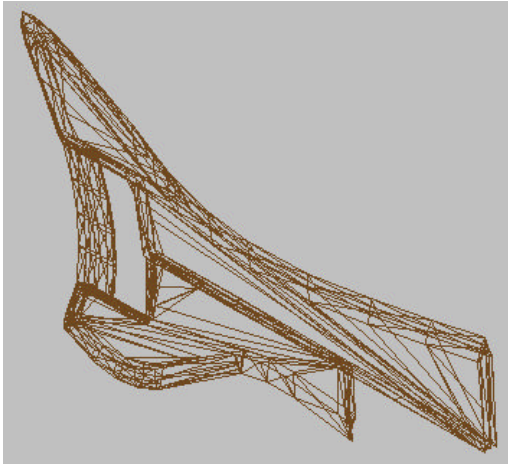
The basic structure of the forward arch was easy to make. I simply extruded a section of the side view. The teeth or spurs were more difficult. Again I studied the many images to find a basic shape. I used a lengthwise extrusion confined within a shaped envelope for the initial object. I then modified the pointed end by boolean subtraction. Finally I added a slight bend with *RayDream's* deformer

capability. This basic tooth was then duplicated, resized, and occasionally reshaped as necessary for each location on the model.

The keels were created separately using the free form modeler by extruding a section lengthwise within an envelope. I shaped the inside edges and added the



hole in the forward keel by boolean subtraction. Like the decks and several other components, the keels extend into the hull.



The tail, shown in wire form, was constructed in three parts. The upper and lower parts were extruded left and right using two identical outside sections and a larger center section. I extruded a horizontal section of the rudder along a curved path.

A number of components, such as the bow spike and the various window glasses, were built with a lathe tool. The anchors, added after I examined the blueprints, are the only stock objects in the model and required some modification to fit.

The *Nautilus* model took hundreds of hours of sometimes frustrating trial and error to build. Although it is very complex it lacks details such as deck planking, which could probably be applied as bitmaps, and rivets, I'm pleased with the results. Next comes the just as complex task of rendering the model in suitable sea world scenes.

-- Michael Crisafulli 4 Oct 97

(Please E-Mail michael_crisafulli@compuserve.com for additional information about this model.)

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