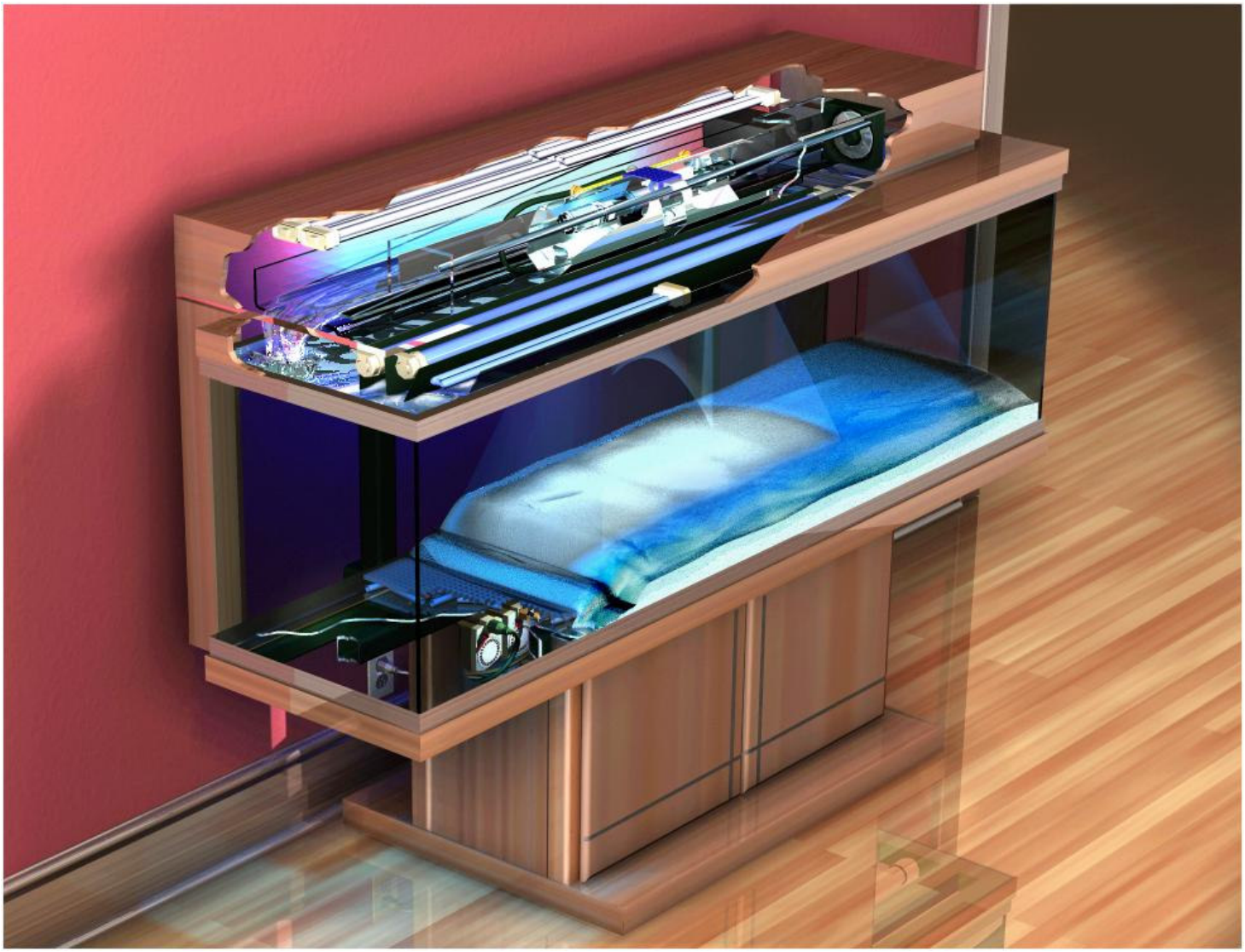

This is a photo-realistic rendering of a true 3-D solid modeled aquarium with cutaways that show more detail of the design.

If you could design your fantasy tank, from the ground up, what would it look like?

Imagine that you could design every phase of your aquarium system, from beginning to end. I was fortunate enough to have that opportunity and I drew up something unique, just to make it fun. I wanted to push the limits of design to see what I could come up with. Of course I had to work around the components of the aquarium, like the size and heat of the lights that had the amount of output that I wanted. Your aquarium would probably not look like mine when you finished it but that is purpose of making a completely custom tank, isn't it?

A few years ago, a local fish store had a sale on a factory delivered 130-gallon tank for only $200. I bought the tank while the special was still in effect, even though I didn't have the necessary equipment to build the system and get it running right away. I stored it away and began to plan the kind of system I wanted to build.

As a Systems Engineer I use Computer Aided Design and Manufacturing (CAD\CAM) software to do true 3-D solid modeling. After I created my designs and I then did photo-realistic renderings. That allowed me to design any new part of the aquarium system and position it directly into the full model. The whole thing could be rotated to see how it worked and how it looked from different angles. When finished I could plot drawings, some of which were full-scale. This allowed me to use spray on mat glue to attach the drawings directly to raw stock and then cut out patterns that eventually fit together like a model airplane. What I saw on the screen was exactly what I got.

CABINET DESIGN:

I decided that I wanted to have a lot of lighting plus a dump bucket above the tank but the top had to have a low profile. I went through several "what if" designs to find the lowest profile to lay out all of the hardware going on top of the tank. Then I began to the design the aquarium cover. Afterwards, I rendered what you can see here. I managed to lower the top two inches more later on.

In the past I designed cabinetry for a living so I decided to create something that was unique. I wanted a modern look similar to the European style with its simple clean lines. If a more classic look was desired, I could have added trim detail molding.

A two-tiered design made the 6 inch top look lower. I added a 3/4-inch recessed inlay area to visually separate the 2 1/2-inch front from the higher back area. The cabinet was stained in a darker finish

to match the inlaid strips in the doors. In the rendering, you can see that I first tried using an aluminum strip as a separator but I found that the darker cherry finish fit better with my other furniture.

Two inlaid strips were spliced into the doors to make them look narrower. The oversized opening was covered with two doors instead of the unwieldy three-door configuration.

I liked the look of a tank that I saw in a book once that had a slight over hang on either end of the base. I wanted to increase the over hang and at the same time make the platform, on which the tank rested, thin and elegant. Unfortunately the aquarium weighs over a thousand pounds. This presented quite a challenge.

A steel skeleton provided the strength that I needed. I use a design to cover the steel with oak veneer, oak plywood and oak strips about the size of yardsticks.

The skeleton was made of 2-inch square steel tubing with a 1/4-inch wall thickness. This tubing has rounded corners. The platform for the tank itself consisted of four cross members that were welded to the steel legs and two end pieces. The platform had to be pretty flat in order to provide good support for the glass tank that only rests on a plastic base around its edges.

The four legs were merely wrapped with veneer. The rounded edges of the steel tubing made the job easy and gave the pedestal a solid oak look. A piece of 1/4- inch oak plywood went in the sides of the pedestal. It was also used on the top part of the bottom most base or foot prints. The oak strips were used as a trim on the bottom base and to encase the steel platform. These yardsticks like oak strips make the pedestal look as if it is constructed of solid wood.

All this worked together to create the appearance of an all wood aquarium stand that looks like it could break because of the weight of the tank. Actually it is quite stable. The low profile cover hides many components that are “under the hood”.

INVERTEBRATE LIGHTING:

When I started this hobby, saltwater fish and reef systems were much more complicated to operate successfully than they are now. Since my knowledge was limited, I decided to buy a used 55-gallon aquarium system that was already working properly. The system was purchased from someone who was trading it for a bigger aquarium.

I still don’t pretend to know what lighting or combination of lighting is best for a reef tank. I wanted to have the standard bearers and a fair amount of variety of light spectrums. My design skills were used to direct the light where I wanted it.

Before I decided to assemble my first system, I wondered why the shop owner of my favorite fish store didn't keep the glass clean all of the time in his show tank. It was his show tank that attracted many of us as customers.

I soon found out what a chore keeping the glass clean can be. If it weren’t for that, keeping saltwater fish and invertebrates would be a very low maintenance hobby. With the strong lighting of a good reef tank, algae can grow quickly on the glass. The routine task of cleaning it can become boring and tedious. Cleaning may also cause accidental scratching of the glass and that can make it even harder to clean.

My first design project on the new tank was to layout the lighting. I could only plot where most of the light would fall when I drew it up. However, with a little planning I was able to direct the lighting onto the invertebrates but still away from the glass.

My lighting system allows me to concentrate a lot of light in some areas of the tank and have low light in others. It was started with a fixed 175 watt metal halide lamp (not shown), two 4-foot very high output (VHO) fluorescent lights and one compact fluorescent lamp. They are all placed at the same end of my 6-foot tank.

I also built a module that is designed to have a pair of 250 watt metal halide lamps move across the tank during the day and then return at night when the lights are off. I am now experimenting with motor drives and circuits.

This module was placed between the florescent lamps and the dumb bucket. This placement is used so that the metal halide bulbs will have the most direct exposure to the shallow water corals that like it.

The pin-point white light sources that medal halides produce causes a shimmering look in the tank when it interacts with the small waves at the water surface. I am still trying to increase this shimmer.

My fluorescent tubes are four feet long so the light that comes from them is softer and more general. These lights hardly cast any shadows and do not add to the shimmer in the tank. For that reason I prefer to make all of my fluorescents actinic or bluish in color. They shine backward and down from their position in the front of the tank. These soft blue lamps are very pretty and soothing to me. They also give the invertebrates other light spectrum combinations that they need, particularly the deep-water invertebrates.

In this way I tried to simulate the soft blue light of the sea, accented by the shimmering of sunshine peering into the shallow waters.

Finally, I used louvers to direct the light where I thought it was most effective and away from the glass at the front and back of the tank. That it was pretty easy to do. The metal arc lamps are very hot so they required a 6-inch by 6-inch square tub to channel the fan blown air past the bulbs, which keeps them cool. This was the minimum height that I could safely get away with and therefore dictated the height of the tank cover. This height, on the other hand, gave me the freedom to use almost wrap around reflective louvers to direct and concentrate the light into the center of the tank. There was no spill over onto the glass. I found that polished aluminum reflectors on top of the lamps only and fully rusted surfaces on the sides made the shimmering stronger because it accentuated the look of the one point light source.

Even though the VHO lamps were from 4 to 8 inches from the front of the tank they were easy to shield. This was possible despite the fact that they were under the part of the cover that was only 2 1/2-inches high. In the very front I decided to use a PowerCompact fluorescent from Custom Sea Life, Inc. It produced about the same light output as two VHOs but was much smaller in size. By using this type of lamp, I could nestle the bulb higher in the cover to increase the effect of the louvers.

This technique greatly reduced the frequency and the difficulty of the glass cleaning that was required. I find that I can now keep my hands out of the tank more and just enjoy this low maintenance approach.

After putting a lot of lights under that low cover I used Ice Cap electronic ballasts from Champion Lighting & Supply to lower the heat output. I even use one that powers a metal arc lamp that was

given to me as a Beta Test unit. All the ballasts are kept either under the tank or just under the floor of the room.

Blue back lighting adds to the over all look of the tank.

AESTHETIC LIGHTING:

My tank is placed about 6 inches away from the wall. I got used to looking through the tank and seeing the wall behind it. Later I placed a blue mask on the back of the tank. It looked good but the tank looked so much narrower that I took it right back off again.

I used some VHOs that were given to me to light the wall at the back of the tank. Over the lamps, I placed dark blue "deep dyed polyester color filters" or "Gels" that are commonly used as theatrical lighting filters. This combination casts a deep blue light on the wall that can be seen as you look through the tank. I first experimented with a 25 watt blue incandescent light bulb but it was too faint to do the job. The VHOs and filters worked quite and provided a beautiful rich color as a backdrop for the tank. The Great American Market sells optically clear "Gels". I used #850 (Primary) Blue. You can also obtain spectral distribution charts of their 130 plus colors and shades.

THE DUMP BUCKET:

I liked the idea of seeing an interesting rush of water and bubbles splashing into the tank periodically. A dump buckets can also cause a localized surge of water turbulence that is valuable to invertebrates. I like the sound of the splashing because it can also be soothing. Coupling a dump bucket and an algae scrubber can add a lot of function to a small space.

I read Dr. Adey's book DYNAMIC AQUARIA a few years ago and then started to design my first algae scrubber. On my third try I felt that it was ready for my first tank. My new tank has design number four. It is 4 feet long, 6 inches wide and only 4 inches high. I placed under the bucket. The fulcrum is positioned just beyond the balancing point of the tray. As the bucket starts to be filled, the water pools in the thick end of the tray. As the bucket becomes more full, the water extends into the tapered end of the tray. This changes the balance of the bucket and it quickly tips downward, dumping out its contents. When the water cascades out of the bucket, the tray rights itself to start another cycle. I fine-tuned the balancing point by moving the fulcrum around until the tray filled to the brim before toppling over.

Adding strong lights above the tray causes algae to used a steel weight at one end of the flattened bucket. This became a counter weight at the thick end of the tray. I was very careful to encase the steel in plastic so that rust would not get into the tank. Rust from metal can be devastating to a tank's invertebrates!

About a foot way from the thick end of the tray, it begins to taper like a wedge, coming to a point at the far end of the dump bucket. I made a simple fulcrum that was grow in the shallow tray. I stopped using a screen and found that it worked even better growing right on the plastic at the bottom of the tray. Since the water in the tray is swallow and the strong lights are closer to the plastic surface than the rock is in the tank, the algae in the tray out competes for the nutrients in the water. This depresses the growth of hair aglae on the live rock in the main tank. The dumping action is said to increase the effectiveness of the algae and seaweed in the bucket by 50%. Plants also absorb metals that can find their way into the tank. With the scrubber installed, my tank's nutrient levels are lower than the commercial test kits can measure.

I don't have to adjust the dump bucket. It works well until it is time to harvest or "export" some of the plant material from the tray. About every week or two it stops in the down position because it is weighted down with algae. It works just fine in the down position but lets me know that it is time to grab a handful and through it away.

I also drop a small bag of carbon in the tray but do not pump water through it. Water drifts through the bag to remove dissolved organic compounds but is not a mechanical filter that can trap things and foster decay. This carbon is there for insurance only. Steve Tyree of Dynamic Ecomorphology and author of THE PORIFERA (LIVING SPONGES) feels that the sponges and other filter feeders, that I grow in the tank, help to remove these dissolved organic compounds on there own. He also feels that they also help control bacteria and any "green water" that my turn up in the tank. This water discoloration has never turned up in my tanks.

Having so much water in contact with the air in the room as it leaves the bucket, keeps the tank temperature within a narrow range. I heat and air-condition my house instead of heating and chilling the tank. If I don't use the AC in the summer time the falling water acts as a "swamp cooler" because it allows water to evaporate, keeping the tank in the mid 70s.

Half of this dump bucket hangs over the back of the tank. This makes room for the lights but still lets the water splash into the tank.

ALGAE OR PLANT LIGHTING:

I bought a $10 halogen lamp for my first tank's algae scrubber. This lamp was very hot but it did not raise the water temperature in the tank. It did cause much evaporation so I had to add lots of replacement water. I placed the lamp about a foot away from the algae scrubber tray. This setup worked fine under the tank but if I used a halogen lamp under the cover that I designed, it would cook the algae.

I used four common compact lamps to light my dump bucket/algae scrubber on the new tank. These bulbs in the 4500K range are just fine for growing plant life and are made by GE and Sylvania in several different sizes. You can buy them from regular commercial lighting companies along with their ballasts. These common bulbs can be used on a Leng Sy Ecosystem styled plant filter instead.

Although the algae scrubbers have served me very well, I am moving the lights to this type of system down stairs as an experiment. I will pump the water from it, back to the tank with a Dolphin 1200 Mini Pump because it is quiet and does not add much heat to the system. After moving the lights to the caulerpa system, I will use the additional space to enlarge my dump bucket.

SAND LAYOUT:

As you can see in the rendering, I used the Jaubert style system to set up my sand bed in the tank. I started with some finger length pieces of 5/8-inch diameter PVC pipe that I used as risers for the plastic egg crate style light defusers. This created a

plenum or open space below the sand bed. I placed fiberglass or plastic screen over the egg crate.

On top of the plenum I placed one inch of coral gravel and another screen. This keeps the worms and other little animals out of the bottom portion of the tank. Then I added four more inches of coral sand from CaribSea, Inc. They provide a consistent grain size in their aragonite sand. It allows good water circulation through the bed because it doesn't pack down. You definitely do not want to use beach sand.

The plenum stops a few inches from the front of the tank because I wanted the sand to slope as it gets near the front glass. This was simply a cosmetic decision. I felt that it looked better that way.

I used Reef Sand Booster from Marc Weiss, Inc. to promote the growth of bacteria in the sand bed.

The bottom of the tank is open so I can see the glass from underneath the tank. I coated a soft magnet with epoxy resin and put it in the bottom of the plenum before adding the sand. Now I can use an external magnet to move the internal magnet across the bottom of the tank. This way I can see what kind of sediment is finding its way to the bottom of the tank.

IT'S YOUR CHOICE:

I hope that you found this exercise in design interesting. I had a lot of fun doing it. I also hope that you have found some things that might cause you to explore the limits of customization. Perhaps you will come up with some new and fun ways to design your own tank setup.