2021 - 2022 City Model Slideshow

Saint Cecilia School
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City Team Name : Gemma Maris

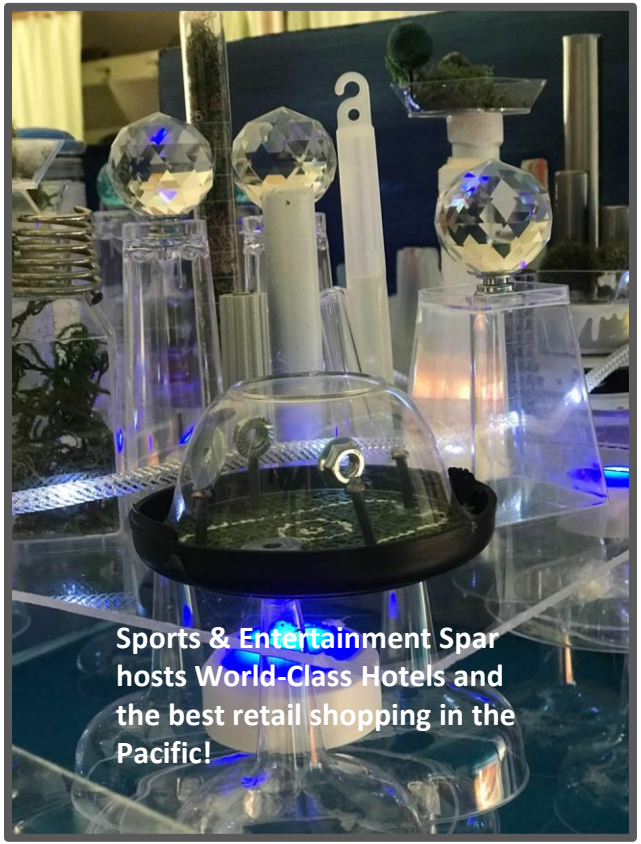
TWO PHOTOS to GIVE JUDGES AN OVERALL IDEA OF THE CITY

SECTION I
GEMMA MARIS - CITY DESIGN

Residential Zone

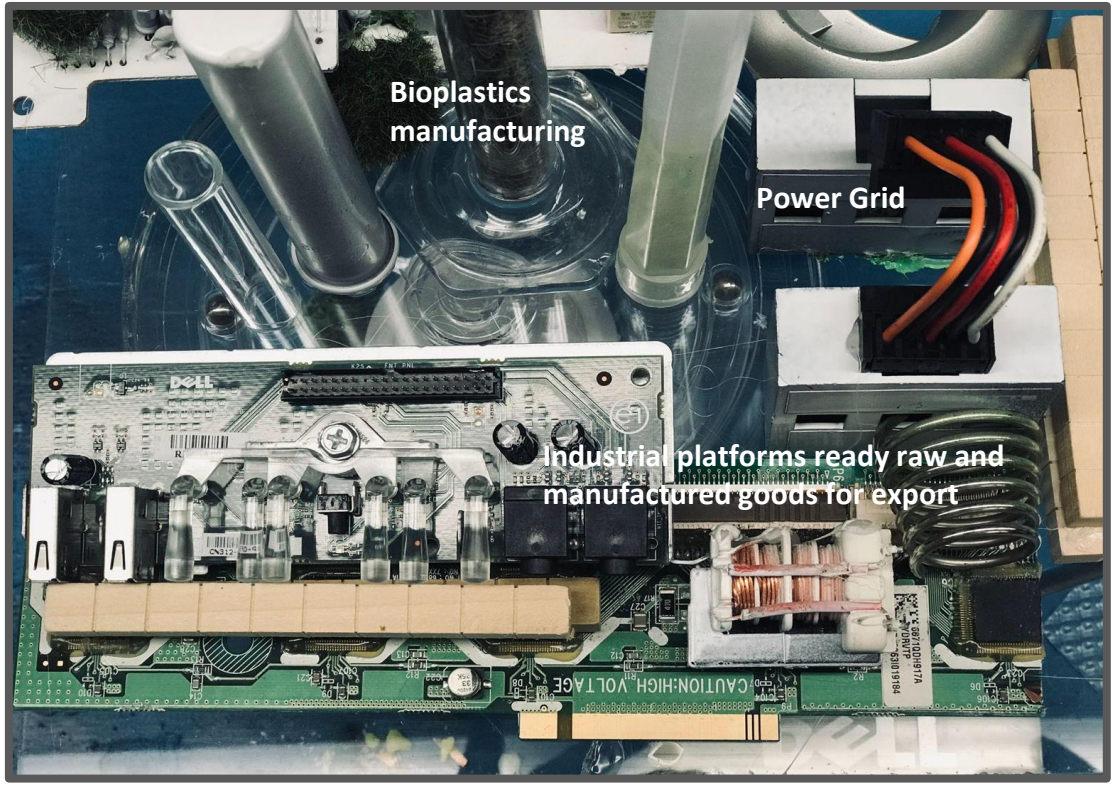
Residential Zone : Gemma Maris city planners designed our buildings following the transit-oriented development model. Mixed-use high rises house residents as well as commercial and entertainment space. Building up, not out, each building rooftop contains parks and terraces for residents to enjoy the outdoors. Skyway bridges connect rooftops for easy transport between buildings. All the needs of residents are within a 10 minute commute of their house.

Commercial Zone



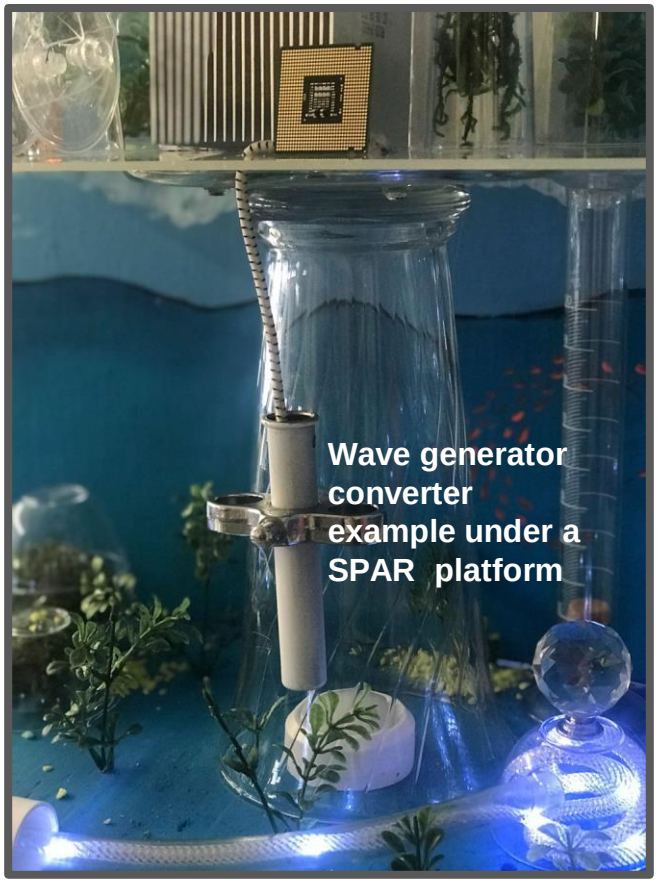
The “Jewel of the Sea” is found in city planners’ development of commercial spaces with retail, grocery stores, multi-family rentals found in Sky Gems. The Vertical Agricultural Towers VATS supply fresh produce and meats to all locations throughout the city daily along with seafood and kelp products from our under-the-sea commercial farming and fishing industry. Gemma Maris has a Employer-provided child and senior care center in all of our residential buildings. Retail shopping for all of residents’ needs also found in SkyGems. GM is a popular destination for travelers, GM hotels are found in many TOD skyscrapers as well as our first class Ocean Gem Resort located adjacent to the Spar Square hosting our sports facilities and main ocean sports locations.

Industrial Zone



To preserve the beauty of the city, the Gemma Maris industrial zone is located away from the residential and commercial areas. The industrial zone drives our Hulasphere circular economy. The GRAB process platform conveys trash from the ocean where it is dried, shredded, blended and molded into building materials such as roof tiles, shingles, decking and pavers. The biogas plant takes organic wastes and converts them into biogas. Excess electricity converted to heat and stored in our molten salt tanks. The wastewater treatment plant processes all municipal and industrial waste flows, sending the solids to the GRAB platform or anaerobic digester. The effluent water is sent to the water treatment plant for reprocessing.

Infrastructure Example 1



Wave Energy Converters

Renewable energy is key to the Hula Sphere circular economy. Buoys connected to a magnetic piston rise and fall with the waves. The magnets move inside a stator where electricity is generated.

Molten Salt Energy Storage

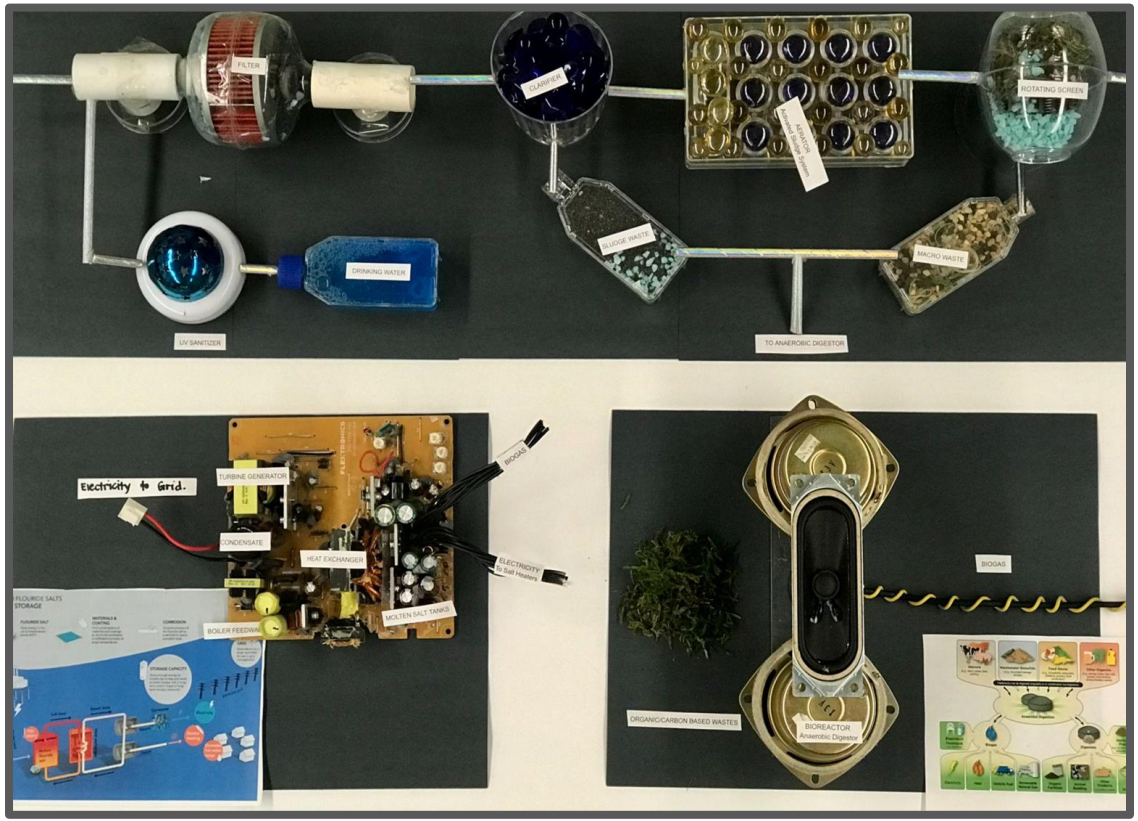
Excess electricity is converted to heat and transferred into our molten salt tanks. During peak electric days, the molten salt is sent through a heat exchanger where water is converted into steam that turns a turbine generator and generates electricity.

Infrastructure Example 2

Floating SPAR Platforms

To create a floating city, Mechanical Engineers borrowed spar platform technology from the oil and gas industry. The city consists of a network of 100 spar platforms connected by rigid bridges. Fixed Equipment Engineers manage the coating and cathodic protection programs to preserve the steel structures from the salt environment of the Pacific Ocean. All utilities are run under the platforms. In addition to providing buoyancy, the spars are habitable spaces with panoramic views underwater.

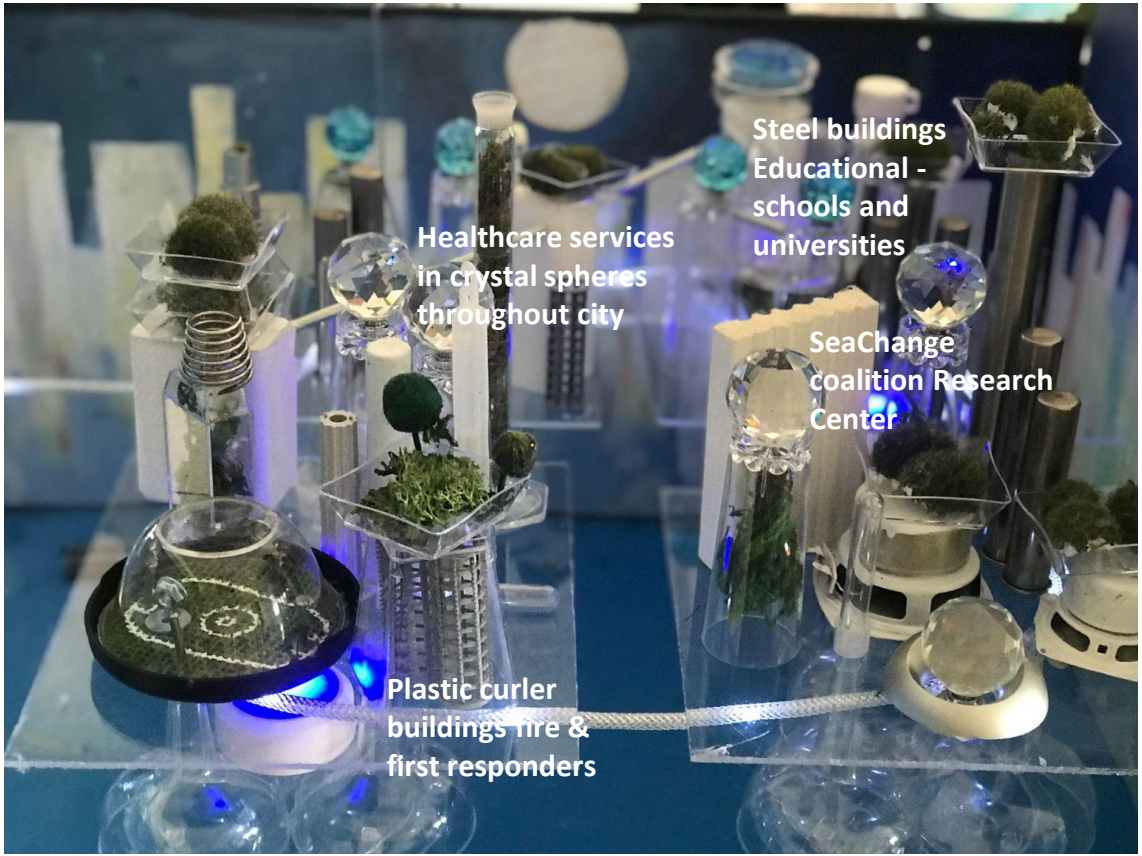
City Services Example 1



City Services 1 : <u>Wastewater and Water Treatment</u>

All industrial and sanitary sewers flow to the GM's wastewater treatment plant. Macro solids are separated in rotating screens where organics are sent to the anaerobic digester where they are converted to biogas while non-organic solids go to the GRAB process to be converted into building materials. Activated sludge system oxidizes contaminants in the water. Sludge waste is sent to the biodigestor where it is converted into biogas. Clarified and filtered water is sent to the Water Treatment plant to be further treated and sanitized into drinking water.

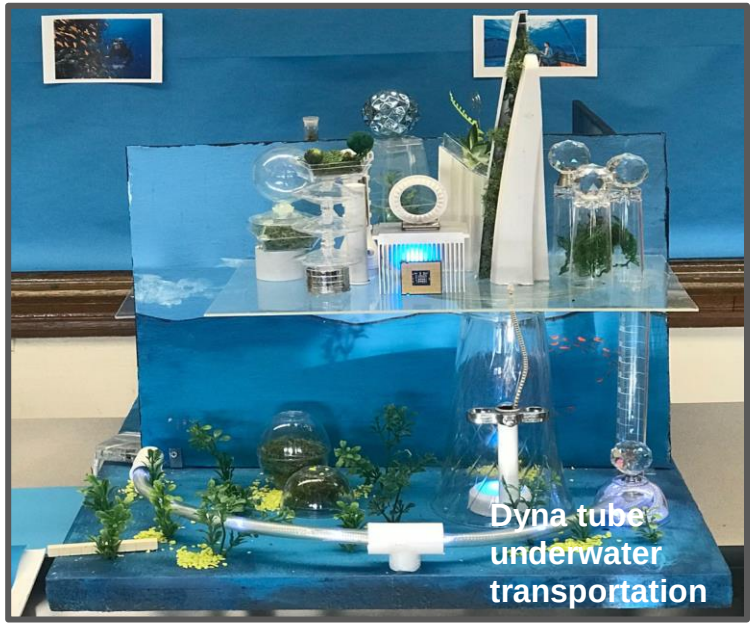
City Services Example 2



City Services Example 2
Emergency Services, Education and Healthcare

Gemma Maris' mayor and city council implemented a tourism tax to fund emergency services, education and healthcare. The fire department uses unmanned drones to respond to fires and medical emergencies in our highrises. Primary and Secondary education is free to residents while Post-secondary education is subsidised. Healthcare is free for residents with urgent care clinics located in each high-rise building to tend to the needs of those in our multi-use buildings. Some examples illustrated here.

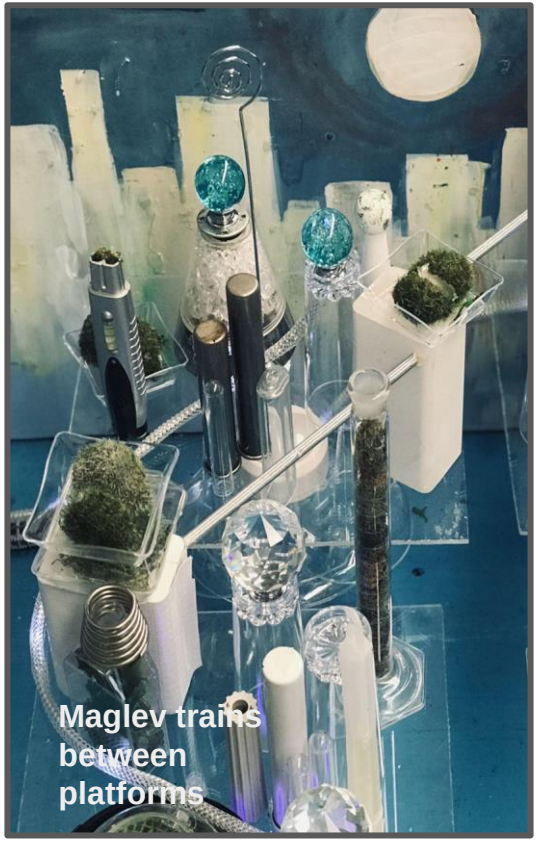
Transportation Example 1



Transportation Example 1 : <u>The Dynatube</u>

Gemma Maris residents and visitors use our high-speed, underwater transportation system called the Dynatube. Passengers ride in shuttles that are propelled and slow down through the tubes by linear magnetic accelerators. As the shuttle moves through the tube, a compressor fan on the front of each shuttle pulls air in reducing drag and creates a low friction cushion of air around the shuttle resulting in it being centered in the tube. The low drag, low friction environment allows the shuttle to travel at 500 mph. The 250 mile trip from Gemma Maris to Hawaii takes 30 minutes. From Hawaii, residents and visitor connect to the world via the international airport.

Transportation Example 2



Transportation Example 2 : For travel within Gemma Maris, commuters have 4 options. The bicycle share program is available for all to travel around the city. Skyway bridges connect building rooftops for convenient travel commuting between our mixed-use, high rise buildings. Piezoelectric footstep generators convert the kinetic energy from walking into electricity. High above the city, zip pods are used for fast travel between retail, business and entertainment hubs. A magnetic levitation rail system is suspended under the floating platforms of Gemma Maris for longer commutes throughout the city.

Principles of a Circular Economy *HulaSphere*

HULASPHERE CIRCULAR ECONOMY- STEP 1:

<u>Design out packaging and Replace with Renewable Bioplastics</u>

Food producers and goods manufacturers worked with retailers to design out single-use plastic and paper packaging. They shifted their wholesale and retail models to force consumer engagement by transporting their goods in bulk containers. Bio-based plastics are used for the packaging needed to protect food and goods during transport. Using the abundant giant kelp forests in the Pacific Ocean, Materials Engineers developed resilient bioplastics to replace oil-based plastic packaging. For kelp growth, CO_2 is consumed during photosynthesis resulting in net-zero carbon emissions for the production of our bioplastics.

Principles of a Circular Economy *HulaSphere*

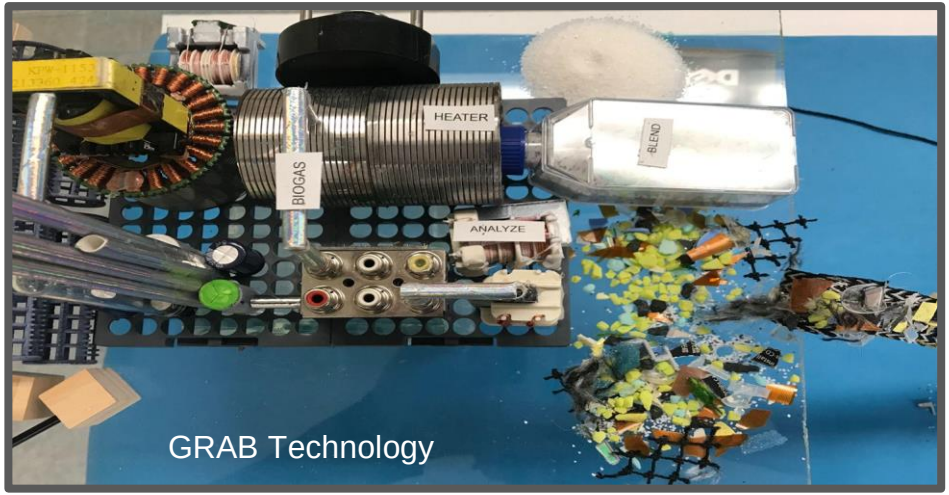
HULASPHERE CIRCULAR ECONOMY- STEP 2:

<u>Standardize retail and incentivize consumers to reuse packaging and containers</u>

Consumer engagement is key to a successful circular economy. All manufacturers and retailers follow the zero-waste philosophy. Manufacturers provide their goods to retailers in bulk. Food markets follow the Fill-Weigh-Pay model where consumers fill their own containers, weight the product and pay by weight. Goods are provided with as little packaging as required to safely transport. Consumers and delivery services take care in transporting from stores to their final destination. All packaging is intended for reuse and is made from post-consumer paper or biodegradable bioplastics. Consumers receive monetary incentives for reusing containers and packaging by paying a reduced rate at the register.

Principles of a Circular Economy

HulaSphere



HULASPHERE CIRCULAR ECONOMY- STEP 3:

Sustainable disposal of packaging and food wastes Identifying inability to fully design waste out of daily life, GM Chemical and Materials engineers developed infrastructures to close the loop on the Hulasphere circular economy. Oil-based plastic wastes and glass are sent to our GRAB process. Plastic is shredded and blended with sand and pulverized glass, heated, liquified and converted into building materials. Paper and bio plastic waste are sent to our anaerobic digester and converted to biogas and fertilizer for vertical farming towers. Human, livestock and food wastes enter our wastewater treatment plant, screened out and sent to the biodigestor for conversion. Nitrogen-containing liquids are sent to our vertical farming tower and giant kelp forest for use as fertilizer for our bioplastic and food production.

Section II
Build it : Quality, Scale and Materials

Innovative Material & Use Example 1

Innovative Material & Use Example 1 :

Everything gathering dust in the Future City bins is dragged out each year.

Our student-engineers pull items from FC bins and brainstorm on how to build the city main features and futuristic technologies from the recycled items.

Team members collaborate and put together a presentation model. Nothing is wasted. We are on a budget, after all!

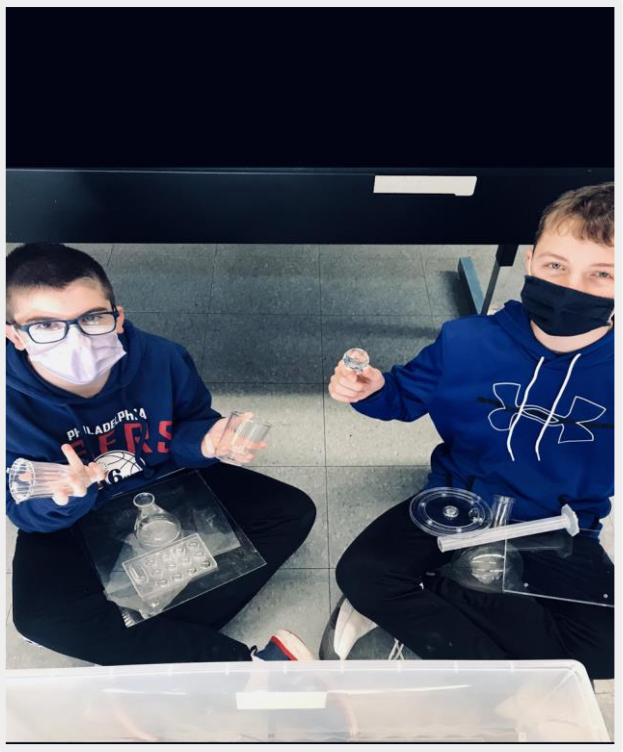
Pictured here are the students putting together our wastewater and sewage infrastructure using primarily the computer parts from the bins.

Innovative Material & Use Example 2

Innovative Material & Use Example 2

A bin of “Nearly natural,” ferns and spider plants that almost made the trash two years ago, are this year used to model our giant kelp farms growing under the SPAR platforms of Gemma Maris. These giant kelp are key to GM’s circular economy, to make bioplastics and as a source of food for the residents. Giant Kelp is key to the Hula Sphere circular economy!

Innovative Material & Use Example 3



Innovative Material & Use Example 3 :

Transparent materials are a key component of the Gemma Maris City model this year. Plastics, glass, and door knobs are just a few of the many recycled and clear objects we used creatively in our Future City model for

Example of Scale 1” = 50 feet

Height of Gemma Maris Health Crystals = .7”

Sky Gems are based on the concept of Arcology, a combination of architecture and low impact human ecology buildings used in densely populated spaces. Height = 6 - 8 “

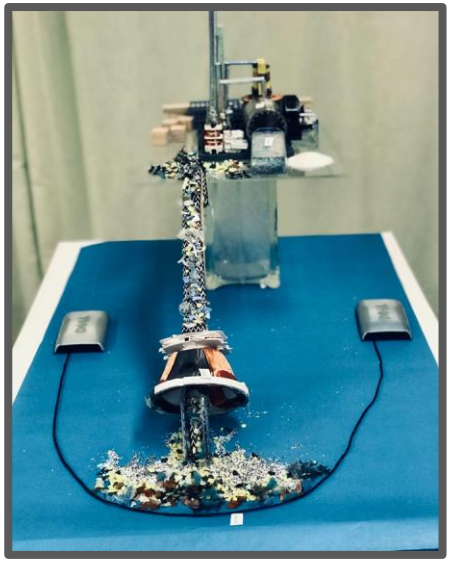
Base of SPAR squares rise from the ocean surface measuring in at 2”

Moving Part Video

https://www.youtube.com/watch?v=qKfR7werHtE

Section III
Judging Assessment of Model

Futuristic Technology Example 1



Gemma Maris Futuristic Technology- Example 1

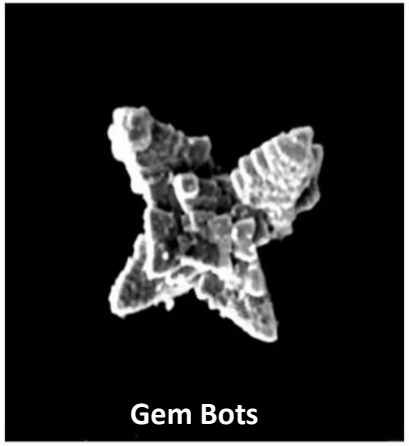
The Gemma Maris GRAB process stands for Gather, Remove, Analyze and Blend. Designed in 2021 by Mechanical, Chemical, Electrical and Materials engineers as the main process to clean up the 160,000,000 lbs of floating plastic waste in the Great Pacific Garbage Patch. The process starts with unmanned surface vessels towing floating collection booms through the Garbage Patch to **Gather** and transport waste to the GRAB platform. At the platform, conveyors **Remove** the floating waste from the ocean and stockpile on the platform. The plastic waste is dried, shredded and **Analyzed** for chemical composition. Based on the analysis, the shredded plastic material is **Blended** with crushed recycled glass and sand and sent to a heater that runs on biogas to melt the plastic/glass/sand blend before it is placed in molds to produce building materials such as roof tiles, shingles, decking and pavers. The GRAB process is integral to the Gemma Maris Hulasphere circular economy for repurposing the plastic and glass waste streams.

Futuristic Technology Example 2

Tiny Robots Could Clean Up Microplastic Pollution

In a proof-of-concept study, microscopic self-propelled devices found and broke down microplastic particles

By Scott Hershberger on September 1, 2021



Microrobot. Credit: "A Maze in Plastic Wastes: Autonomous

Gemma Maris Futuristic Technology: Example 2

To breakdown the microplastics unable to be removed from the Garbage Patch by the GRAB process, Materials engineers developed nanorobots called GemBots. These nano-robots are attracted to microplastics and oxidize the plastics in the presence of hydrogen peroxide. To collect the GemBots from the environment, a magnetic field is used to gather and remove them from the ocean. Bioplastics are produced to replace oil-based plastics to avoid bioaccumulation of waste plastic in the marine ecosystem. GemBots and bioplastics are another technology that anchor the Hulasphere circular economy.