ARCHITECTURE NARRATIVE

In designing our DURAhome, TeamDURA drew inspiration from our environment and our experiences as students living in New York City: we live in a post-natural disaster, high-density environment in which there are countless different cultures and backgrounds.

DURAhome creates a comfortable living environment focused on a whole life approach and high-performance energy-efficient technologies. DURAhome's plan is dynamic and spacious yet efficient. Special attention was paid to light: we have ample sunlight, and warm materials will be used in building to optimize ambiance. Our high ceilings add to our spacious feel. In addition, its slender lot size with measurements of 24 X 50 allows the design to fit within most New York City lots. DURAhome is an urban solution to energy-efficient housing developed through a multi-pronged approach: a hybrid of passive and active systems that can adapt to various urban configurations. Combining elements of passive ventilation with Passive House building principles results in a highly-efficient house with reduced cooling loads in the summer and reduced heating loads in the winter. Solar shutters with panel orientation that is seasonally optimized allows for higher efficiency than traditional single-angle installations. Taking the sun's path into consideration, we placed these shutters along our south wall so as to maximize solar intake.

DURAhome allows for flexibility. Our open floor plan and modular design puts the homeowner very much in control. With a focus on adaptable spaces, DURAhome is customizable to cater to a variety of needs: a bedroom doubles as a home office; our patio doubles as an eating space; our adaptable room doubles as a child's room, a separate office, or an open space. Our foldable furniture optimizes space, allowing for even more freedom within our home. Thanks to our modular design, DURAhome is easily transportable in trucks, if the need arises.

The energy-efficient technologies utilized in our design are high-performance. An optimized envelope and form and an efficient mechanical system allows the building integrated 6.9kW PV array to provide all power. Our building integrated solar facade is an urban appropriate construction system that includes prefabricated and offsite strategies. The dweller-responsive, manual individualized operation responds to the urban dweller and can adjust according to a wide variety of lifestyles.

Modularity played a very big role in our design and assembly. Special care was taken to ensure that our modules do not require oversized trucks to be transported; this ensures that transportation is both cost efficient and easy to arrange. Modularity makes the home transportable for the homeowner, but, perhaps more importantly, it allows for our home to be disassembled and dispatched as post-disaster relief, as needed. To make this transport process as smooth and easy as possible, we arranged for all of our mechanical systems to fit into one module, our wet module. In this wet module is our kitchen, our bathroom, SunDrum hydronic solar collector, our clothing washer and dryer, our Energy Recovery Ventilator, and our mini-split air conditioner. We refer to

this module as our “service” module, with our other two modules labeled “living.” The other two modules contain our decking and our bedroom.

Our home was designed with connections in mind, both to the natural environment and our community. Our front and back porches, as well as our facade all function as connection points to our surrounding neighborhood of Red Hook. Unlike front and back porches in more suburban environments, in New York City, the back porch is often seen as a public space, whereas the front porch is more private. Because of high-rise buildings, neighbors have an elevated view of all that is happening in a backyard, making it a very public and community accessible part of one’s home. The front porch, however, is usually not in anyone’s view, so long as it is not rush hour and people are not commuting to/from work. Our facade is a burgundy red: the color of Red Hook’s red clay soil foundation, which is the material that gave the neighborhood its name. We were sure to have connection points to our natural environment by installing a vertical green wall inside the home. This remind our residents of the importance of nature, and reinforces the idea that we rely on the natural environment to filter our air and provide our food.

MARKET APPEAL NARRATIVE

A DURAhome is designed in an exciting, positive-energy environment. We carried these traits into the design of the project itself. Our home is geared to best accommodate young, urban families who are community oriented, passionate about energy conservation, and who believe that one's home is an important factor in the richness and overall quality of one's life. If one is constantly surrounded by good energy flow and a pleasant environment, they can expect greater work productivity as well as flexibility to entertain friends and loved ones in their amiable home. The multifunctional qualities of a home are an intrinsic to a compact modular space allowing the user to quickly and easily interface between private work areas and flexible living spaces. Our home was designed with light in mind. DURAhome has ample natural sunlight, reflective materials and exterior and interior wood finishes.

The initial cost of the home will be repaid over time in the energy, appliance, and grocery bill savings. Aside from passive elements to reduce energy consumption, we also have active elements in play to assist with lessened energy consumption and to further recycle resources. With a modular design and an open floor plan, our home is adaptable to many different ways of life. The home can be taken apart and shipped in times of dire need, such as a natural disaster. Our home can be elevated to comply with local building codes. It can also be stacked upon itself up to four stories to suit a dense urban environment. There are several adaptable spaces which can be used to accommodate a home office, a bedroom, a mechanical room, or a child's play area, depending on the client's needs. Furthermore, our home will contain several pieces of foldable furniture which can be accessed when needed, and otherwise put away and stored to maximize space.

DURAhome will promote community in places where it is perhaps most needed - urban flood zones that are vulnerable to damages inflicted by natural disasters benefit from a sense of community and support in the aftermath.

COMMUNICATION NARRATIVE

Our communications strategy was geared towards connecting our students with our audience and our community. We found that we got the best feedback when we posted photos of students, as opposed to simply features of our home, no matter how innovative and interesting they were. We began posting “thank yous” to sponsors when we had site visitors, in which students would pose with visitors and elements of the home. Showing how involved our decathletes were with the innovative technologies and big named products shaped our strategies greatly.

Our blog posts are centered around that which makes us DURA. We had three categories of blog posts that stayed constant prior to, and during construction. These categories were “All around the world,” “In NYC,” and “A few of our favorite things.”
“All around the world” highlighted international updates on anything that we felt was interesting and had to do with sustainability, architecture, or urban planning. “In NYC” is similar to “All around the world,” with the exception that it was centered around New York City. “A few of our favorite things” were updates on innovative sustainable technology. Once construction began, we would post updates on construction progress, as well as sponsor-centered posts, when they were relevant. With our sponsor posts, we would be sure to explain why certain installations were important and how they were aligned with our aims. Relevance refers to where we were along our construction process. In this way, we engaged and educated our audience while giving our sponsors recognition.

In designing our website and our public exhibit material, special care was taken to look good graphically, which includes good usage of colors, graphic design, and text placement. Of course, text was a priority in all of our materials, but we also recognized the importance of graphic appeal when appealing to big audiences who may not otherwise be interested in sustainable building practices. Aside from attractive signage and interesting material, we were sure to play on everything that make us and this project exciting: student empowerment, hands-on experience, innovative technology, an international intercollegiate competition founded by the Department of Energy, sustainable building practices, solar energy, students in construction, and big named sponsors’ support.

Apart from our blog, our main mediums for social media include Facebook, Twitter, Instagram, and Pinterest. Our Pinterest was more of a strategy to spread others’ ideas around. Not very many of our own practices and original content were put out onto Pinterest. We had mainly repinned and liked other people’s posts on architecture, green living, and sustainability. Instagram was meant to post interesting and eye-catching photos; we found that overloading on content wasn’t effective on that medium. Twitter was reserved for quick daily updates and link sharing. We found we had the most audience response when we retweeted and responded to other accounts’ posts. Twitter and Pinterest were the most interactive mediums, yet the nature of the interactions were different: with Twitter, interactions would only occur as reciprocations. We found that our Pinterest community held no expectations of reciprocation. Finally, Facebook was our most responsive outlet. In this medium, we would post our major accomplishments as well as any

construction milestones that we had. We had a lot of help from the City Tech News Facebook page; their account would share a lot of our posts. Students involved in construction would also share and like posts across all of our mediums.

One of our most successful likes campaigns included inviting friends of friends to like our pages and follow us. We found that audiences were much more engaged when they saw updates on students and decathletes that they knew personally.

ENGINEERING NARRATIVE

The engineering strategy for DURA is based on overall efficiency and user-friendliness of the house's technology. Emphasis is placed on making the homeowner feel at ease with the use of advanced and integrated technology. DURAhome is a hybrid of passive solar and passive house design principles, coupled with low energy active systems. With our off the shelf assemblies, combined with these integrated technologies, the user will feel in control of their home environment.

Mechanical systems within our 6.5 kW array include photovoltaic panels, low-energy mechanical harvesting, a minisplit air conditioner, as well as Energy Recovery Ventilation (ERV). The photovoltaic panels are placed in a vertical sawtooth array. This verticality allows for a crucial design feature of ours-- stackability. The sawtooth array is optimized to sit at an angle in which the panels are getting maximal amount of sun exposure, yet are not shading the panels beneath one another.

We will be using a SunDrum hydronic solar collector system in order to capture waste heat produced by the PV panels, cooling the panels down closer to their optimal temperature. This waste heat is then transferred and used to heat the SunDrum's water tanks, providing hot water without spending energy on heating. The SunDrum system will redirect extra heat away from where it may be harmful, our solar panels, towards where it is really needed, our water tanks. A heat chimney will heat the home throughout colder months of the year and cool the home in warmer months. We have put careful consideration into making our DURA home as efficient as possible.

Our ducted minisplit unit is composed of two main components: an outdoor condensing unit and an indoor evaporator unit. The outdoor and indoor units are connected with tubing and make up what is essentially a central air system with the flexibility of selectively heating or cooling one or more rooms at a time, regulating how much energy is spent on temperature control. Because the tubing connecting our units is so small, we minimize energy lost traveling through long ducts. Thanks to our selective temperature control, we can also minimize energy spent on rooms that may not even be in use.

Our Energy Recovery Ventilator (ERV) acts as an iron lung throughout our home: it extracts moist and stale air from kitchen and bathroom areas and replaces it with clean, tempered, and filtered air at a low velocity to ensure that drafts are not created. Up to 90% of the heat from the extracted air is recovered and used to heat incoming air.

Our electrical and lighting systems have also been carefully selected in order to ensure minimal energy is spent while yielding optimal results. Our electrical panel is a 200 Amp space CH Type Main Breaker. This system provides premium protection from wires overheating and faulty circuits. The electrical box fits comfortably between wall studs and has no bolted connections, minimizing the chance of hotspots and faults. Our electrical panel works in conjunction with our micro-inverter, which lets us individually link all of our electrical modules, as opposed to using traditional string inverters. This, in turn, allows us to control our panel's output individually and offer Maximal Power Point Tracking (MPPT) for each individual module. We chose this system because it minimizes electrical risks: apart from the real time power tracking, separating panels' outputs minimizes damage in case of component failure.

We are using LED lighting everywhere in our home. Beyond their LED classification, our lights are optimized with nanotechnology to ensure smooth and consistent lighting without hotspots. They are also Absolute White lights, meaning our lights are three-step consistent: there is little to no variation between the colors of the lights.

We have a home automation system in place to give the homeowner full control:The DURA home will be fully integrated with sensors around the home to help the residents monitor how much energy they use compared to how much energy is produced by the solar panels attached to the home. The Sensors placed at careful places around the home will allow the used to control the doors and windows lock, the stove, lights, water level and usage, solar panels health and how much energy is being produced, and how much energy each appliance in the home is using. The home owners will be able to monitor their home even when they are not home using a smartphone or a computer application to monitor the activities at home.

Several PassiveHaus elements reduce energy consumption by simply letting the earth's natural systems do the work for us. The house will be thoroughly insulated above and beyond what legal code requirements, as well as built in an airtight envelope, in order to optimize energy loss prevention. Thermal mass will also be drawn upon to minimize temperature fluctuations by absorbing heat when the room temperature is hotter than the mass, and releasing heat when the room temperature is cooler than the mass. Our walls will be constructed so that they do not lose their R value in extreme temperature change, or when wet. Glazing is essential in preventing energy loss, as windows and doors are the number one sources of heat gain or loss in an insulated building unit. Glazing may not only prevent unnecessary heat loss and gain, but also reduce glare and improve internal lighting. Our windows will be triple paned so as to maximize efficiency.

Our engineering strategy will create a pleasant experience for both the residents and the visitors to learn how to use the various functions of the house.