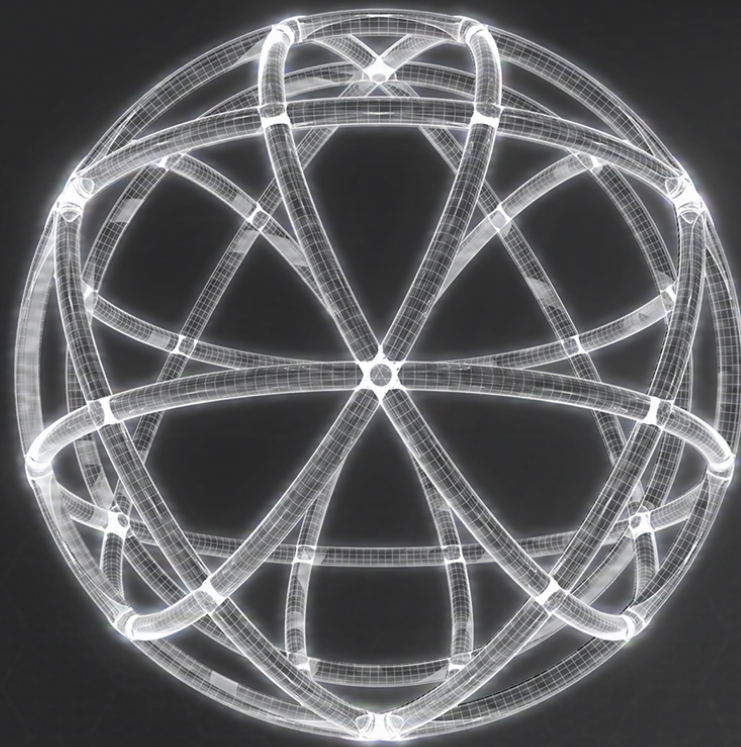


**“JACQUES ROUGERIE FOUNDATION AWARD 2013”**

**INNOVATION AND ARCHITECTURE FOR SPACE**

**DEYAN SAEV  
NGUEN SHON**



**“FOR EARTH”**

***“INNOVATION AND ARCHITECTURE FOR EARTH - IN SPACE”***

## FOR EARTH

THE CONCEPT AIMS AT CREATING A, PREDETERMINED IN ITS GROWTH, SYSTEM, THAT MAKES LONG TERM LIVING IN OUTER SPACE POSSIBLE FOR MILLIONS OF PEOPLE - REDUCING THE IMPACT OF OVERPOPULATION AS A MAJOR GLOBAL PROBLEM ON EARTH. THE COLONY WOULD SIMULATE GRAVITATIONAL CONDITIONS SIMILAR TO THOSE ON EARTH. THROUGH STRICT, CONTROLLED PLANNING, INSPIRED BY PAST URBAN PROJECTS, THE NEWLY ESTABLISHED OUTER SPACE ENVIRONMENTS WOULD AIM AT COMBINING THE BENEFITS OF LIVING IN A CITY, WITH THOSE OF LIVING IN THE COUNTRYSIDE. THE PROJECT PROPOSES TO CREATE A BENEFICIAL AND HEALTHY HABITAT THAT IS FUNCTIONAL AND WOULD NOT DETERIORATE WHEN EXPANDED TO ACCOMMODATE FOR MORE PEOPLE.

HUMANITY IS EVOLVING. OUR NUMBERS HAVE GROWN EXPONENTIALLY OVER THE PAST 60 YEARS, AND SHOW NO SIGNS OF SLOWING DOWN. HOWEVER, OUR PLANET DOES NOT GROW IN SIZE, THE SAME WAY WE DO. THERE IS A STRICTLY LIMITED SPACE, AND RESOURCES ON EARTH, WHICH MIGHT BE ENOUGH FOR THE TIME BEING, BUT ARE MOST DEFINITELY FINITE. WHICH BEGS THE QUESTION - WITH HUMAN NUMBERS CONSTANTLY INCREASING, BUT EARTH'S SURFACE STAYING THE SAME SIZE - IS THERE A LIMIT TO HOW MANY PEOPLE CAN LIVE, WITH A GOOD STANDARD OF LIVE, ON THE PLANET ? THE ANSWER TO THAT QUESTION IS MOST PROBABLY YES, AND IF THAT IS THE CASE, THAN HOW WOULD HUMANITY CONTINUE TO EVOLVE, AND WHAT WOULD BE ITS NEXT EVOLUTIONARY STEP?

TODAY CITIES ARE WHAT MAKE POSSIBLE LARGE GROUPS OF PEOPLE TO ACHIEVE A GOOD STANDARD OF LIVING ON A VERY SMALL AREA. THE DENSITY OF THESE METROPOLITANS HAS BEEN CONTINUOUSLY RISING, TO COMPENSATE FOR NEW PEOPLE, MOVING TO A CITY, EVERY DAY. HOWEVER, TODAY'S BIGGEST CITIES HAVE BEEN FIRST ESTABLISHED WITHOUT A PLAN AS TO HOW THEY WOULD EXPAND HUNDREDS OF YEARS IN THE FUTURE. THIS HAS LED TO A FULLY ORGANICALLY GROWN SYSTEM, WHICH IS HARD TO ALTER TO SPECIFIC REQUIREMENTS AND DOES NOT ALWAYS MEET THE NEEDS OF ITS INHABITANTS. OVERPOPULATED CITIES ARE ONE OF THE MAJOR REASONS FOR THE GREEN HOUSE EFFECT AND ARE WITHOUT A DOUBT STRUGGLING TO MAKE LIFE POSSIBLE FOR EVERYONE - TRAFFIC JAMS, POLLUTION, LACK OF GREEN SPACES, BEING AMONGST THE MOST SERIOUS OF PROBLEMS.

AS FAR BACK AS THE 1900S A LOT OF PROPOSALS HAVE BEEN MADE FOR IMAGINATIVE URBAN PLANS (SUCH AS THE GARDEN CITY MOVEMENT OR THE LINEAR CITY PROPOSAL) THAT AIM AT SOLVING URBAN PROBLEMS,

PRESENT TO THIS DAY. THESE PROJECTS UNFORTUNATELY HAVE NEVER BEEN REALISED, DUE TO THE FACT THAT IN TODAY'S ALREADY HIGHLY EVOLVED SOCIETY IT IS NEARLY IMPOSSIBLE TO ESTABLISH ENTIRELY NEW, LARGE ENOUGH, SUSTAINABLE, TOWN OR A CITY. THUS HUMANITY IS FORCED TO MAKE THE BEST OUT OF THE ALREADY SET CONSTRAINTS AND BOUNDARIES OF THE WORLD, WE OURSELVES HAVE MADE.

WITH ALL OF THIS SAID, MAYBE EXPANDING ON TO THE LIMITLESS VOLUME OF SPACE COULD BE THE SOLUTION. PLANETS AND ASTEROIDS HOLD UNIMAGINABLE AMOUNTS OF RESOURCES THAT WE MOST DEFINITELY REQUIRE TO CONTINUE MOVING FORWARD. FURTHERMORE, THERE ARE NO PRE-EXISTING COLONIES THAT LIMIT HUMANITIES' APPROACH TO SUCH A TASK. THE SO FAR MENTIONED URBAN PROJECT MIGHT BE MADE POSSIBLE AND MAYBE EVEN BETTER EXACTLY IN AN ENVIRONMENT SUCH AS SPACE. FURTHERMORE, IF A PRE-SET STRATEGY, FOR YEARS AHEAD, IS DEVELOPED, IT WOULD ENSURE THAT LIFE ON THE SUSTAINABLE SYSTEM WOULD NOT WORSEN WITH TIME, BUT ON THE CONTRARY - GET BETTER. COLONISING SPACE MIGHT BE THE NEXT LOGICAL AND MOST DEFINITELY GIANT STEP IN HUMAN EVOLUTION - WHICH COULD LEAD TO A WHOLE NEW UNIVERSE OF EXPERIENCES AND POSSIBILITIES.

MAKING LONG TERM LIFE IN SPACE POSSIBLE HOWEVER, IS NOT AN EASY TASK. SCIENTISTS HAVE STUDIED AND PROVEN THE MANY NEGATIVE, A LOT OF WHICH LONG TERM, EFFECTS ON THE HUMAN BODY AFTER LIFE IN A WEIGHTLESS ENVIRONMENT. THIS MEANS THAT IF A COLONY AIMS TO BE THE NEW HOME FOR HUNDREDS OF THOUSANDS, AND EVEN MILLIONS, OF PEOPLE, IT NEEDS TO PROVIDE THEM WITH GRAVITATIONAL CONDITIONS SIMILAR TO THOSE, HERE ON EARTH. AS IT TURNS OUT, THAT IS POSSIBLE, AND HAS BEEN SUBSTANTIALLY RESEARCHED BY NASA THROUGH THE YEARS. SO MAKING HOME OUT OF OUTRACE MIGHT NOT ACTUALLY BE JUST SCIENCE FICTION.

TECHNICAL INNOVATIONS ARE WHAT HAVE SUPPORTED AND INSPIRED PEOPLE TO REACH FOR THE COSMOS. SOME OF THE GREATEST INVENTIONS OF THE MODERN AREA HAVE BEEN DEVELOPED TO BE FIRST USED IN SPACE TRAVEL AND RESEARCH. SUCH A GRAND UNDERTAKING, AS COLONISING SPACE, COULD ONLY BE MADE POSSIBLE, WITH THE SIMULTANEOUS ADVANCEMENT IN TECHNOLOGY. WE MIGHT BE STILL FAR AWAY FROM HAVING THE SKILLS AND INSTRUMENTS OF BUILDING A SPACE STATION OF A GRAND SCALE, BUT WE HAVE PROVEN TO BE WELL ON OUR WAY OF DEVELOPING THE TECHNOLOGIES OF THE FUTURE, THAT COULD SOON MAKE THE DREAM OF LIVING IN SPACE POSSIBLE.

## OVERPOPULATION

TRAFFIC



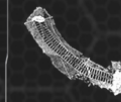
POLLUTION



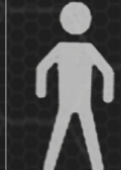
GARDEN CITY



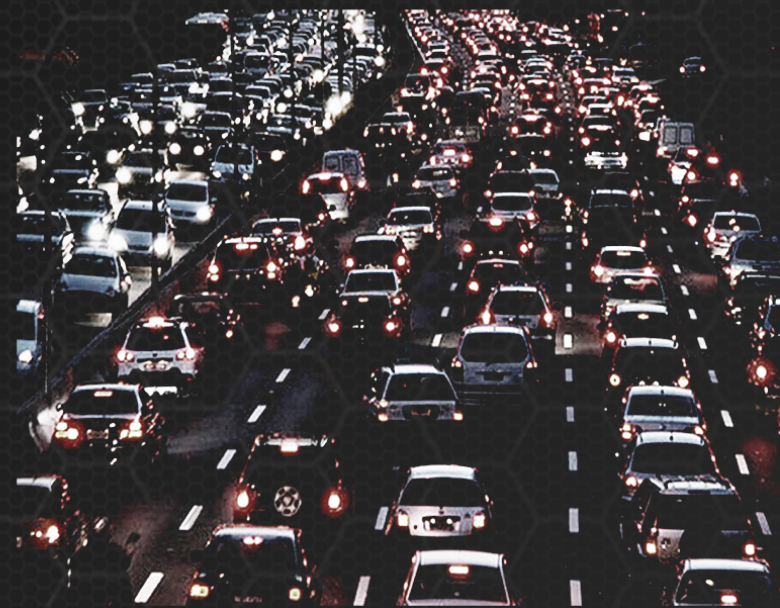
LINEAR CITY



NUMBER GROWTH



EARTH SURFACE

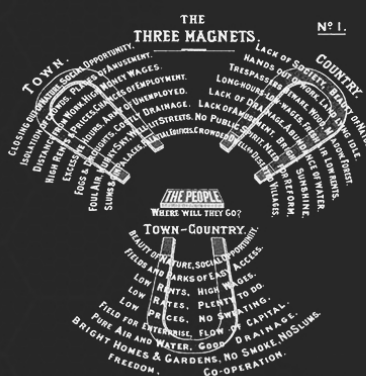
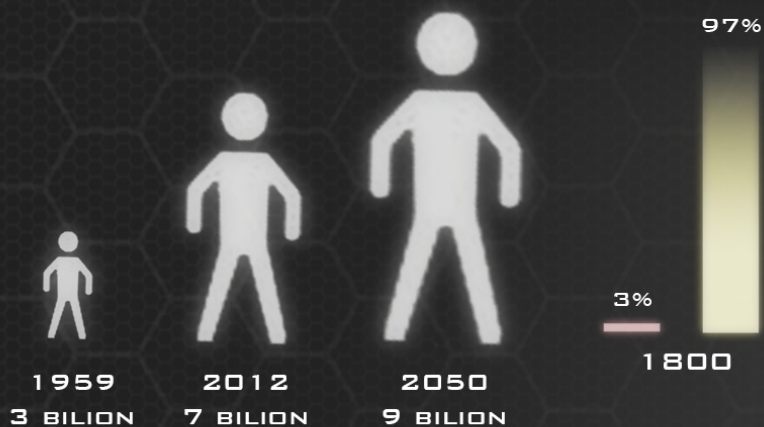


OVERPOPULATION IS THE CASE IN WHICH THE NUMBER OF PEOPLE IN A SET PLACE HAVE EXCEEDED THAT PLACE'S SUSTAINING CAPACITY. THIS CAN BE EXAMINED ON EITHER MICRO SCALE (TOWNS, CITIES, COUNTRIES) OR MACRO - GLOBALLY. WITH OUR PLANET'S CARRYING CAPACITY ESTIMATED BETWEEN 4 AND 16 BILLION PEOPLE, WE MAY HAVE ALREADY PASSED THE POINT OF GLOBAL OVERPOPULATION. THE NUMBER OF PEOPLE ON EARTH HAS BEEN GROWING IN SIGNIFICANTLY HIGH RATES OVER THE PAST 50 YEARS. WITH MORE THAN 6.6 BILLION PEOPLE LIVING ON EARTH, BY 2050 OUR POPULATION IS EXPECTED TO GROW UP TO THE STAGGERING 9 BILLION.

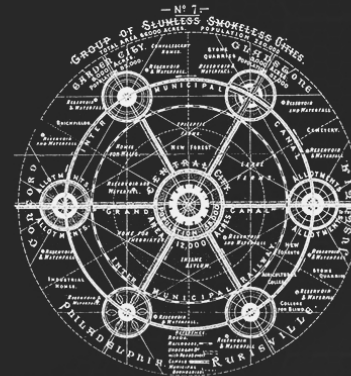
GLOBAL OVERPOPULATION HAS BEEN THE BIGGEST CAUSE OF POLLUTION, GROWING DEMAND OF EVER DECREASING RESOURCES AND THE DOWNFALL OF LIVING CONDITIONS. ALREADY HALF OF HUMAN POPULATION LIVES IN CITIES, AND BY 2050 TWO THIRDS ARE EXPECTED TO HAVE CHANGED TO AN URBAN LIFESTYLE. TODAY'S BIGGEST METROPOLITANS, WHEN FIRST DEVELOPED, WERE NOT BUILT TO ACCOMMODATE FOR SUCH OVERWHELMING NUMBER OF PEOPLE. THE "ORGANIC" GROWTH OF CITIES IN EVERY POSSIBLE DIRECTION TRIES TO MAKE LIVE POSSIBLE FOR EVERYONE, WHILE UNFORTUNATELY WORSENING THE PROBLEMS OF TRANSPORT, SPACE, POLLUTION AND RESOURCES. EVEN AS FAR BACK AS THE 19TH CENTURY, PEOPLE RECOGNIZED THE LONG TERM PROBLEMS OF OUR SOCIETY'S CONSTANT EXPANSION, AND SOUGHT WAYS OF DRASTICALLY CHANGE AND IMPROVE THE WAY WE LIVE. A KEY TO SOLVING THESE ISSUES COULD BE FOUND IN WHAT MIGHT BE CONSIDERED RADICAL, AND UNDOUBTEDLY IDEALISTIC PROPOSALS FOR URBAN PLANS FROM A FEW YEARS BACK.



### GARDEN CITY

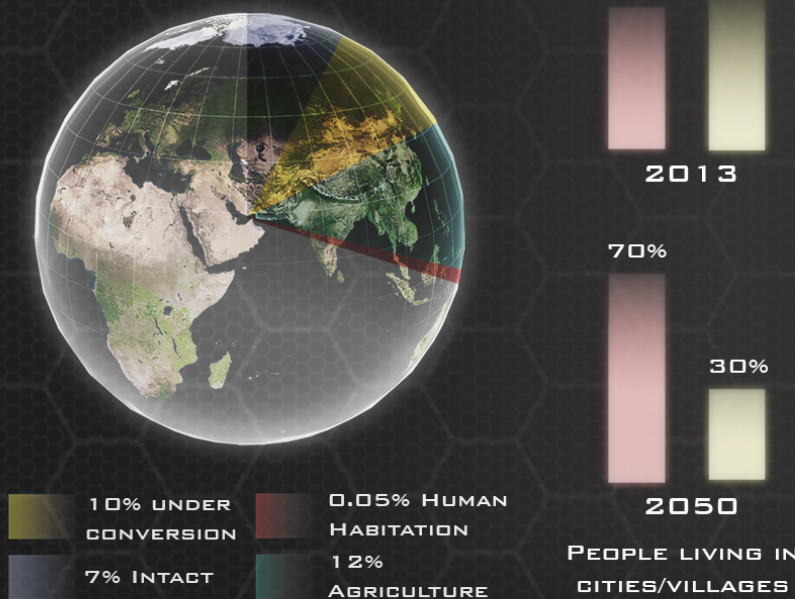


BENEFITS OF A TOWN-COUNTRY SYSTEM



GEOMETRIC LAYOUT OF TOWNS

IN 1898 EBENEZER HOWARD PROPOSED HIS IDEA OF A GARDEN CITY - A TOWN-COUNTRY COMBINING THE PROS OF LIVING IN THE COUNTRY SIDE WITH THOSE OF LIVING IN A BIG CITY. GARDEN CITIES WOULD BE SUBURBAN TOWNS LIMITED IN SIZE, PLANNED IN ADVANCE AND SURROUNDED BY AGRICULTURAL LAND. WHEN THE LIMITS ARE REACHED A NEW TOWN WOULD BE BUILT WITH THE SAME CHARACTERISTICS - TO PREVENT THE UNCONTROLLED OVERGROWTH OF THE TOWNS. EVERY TOWN WOULD BE INDEPENDENT AND SELF-SUSTAINABLE. HOWEVER, HIS IDEA IS MET WITH SKEPTICISM AND NEVER TAKES ON ITS FULL SHAPE. FOR SUCH A SYSTEM TO WORK, HABITATS NEED TO BE ENTIRELY NEWLY ESTABLISHED, WITH A PREDETERMINED STRATEGY FOR YEARS AHEAD. MASTER PLANNING OF THIS SCALE HAS NEVER BEEN DONE IN HUMAN HISTORY AND SEEMED IMPOSSIBLE BACK THEN.



### LINEAR CITY

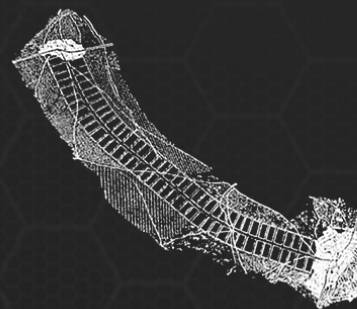
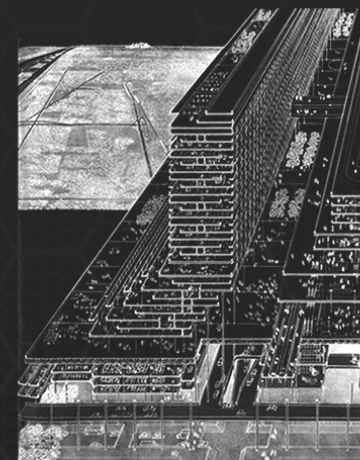


DIAGRAM AND SKETCHES OF THE LINEAR CITY CONCEPT



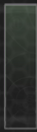
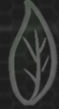
LINEAR CITIES ARE PROPOSALS FOR AN ELONGATED URBAN PLAN THAT GROWS ONLY IN LENGTH, RATHER THAN IN WIDTH. THE CITY WOULD CONSIST OF A SERIES OF FUNCTIONALLY SPECIALIZED PARALLEL SECTORS - PRODUCTION AND COMMUNAL ENTERPRISES, A RESIDENTIAL ZONE, A PARK ZONE, AND AGRICULTURAL ZONE. THEY WOULD HAVE A TRANSPORTATION ROAD THAT WOULD GO THROUGH THE ENTIRE ESTABLISHMENT. A SCHEME OF THIS KIND WAS FIRST PROPOSED BY ARTURO SORIA Y MATA - A SPANISH URBAN PLANNER. IT WAS LATER ON EXPLORED BY THE FAMOUS ARCHITECTS PETER EISENMAN AND MICHAEL GRAVES. THE AIMS OF THIS PROPOSAL WERE TO SOLVE THE PROBLEMS OF TRAFFIC AND CITIES' DISCONNECTION WITH AGRICULTURE AND NATURE. HOWEVER, FOR SUCH A TOWN TO WORK, EVERY DESIGN DECISION HAS TO BE PREDETERMINED AND MADE WITH REGARDS TO THE WHOLE SYSTEM, NOT JUST ONE ZONE OF IT. JUST LIKE THE GARDEN CITY, IT IS NEVER REALIZED.

# URBAN PLANNING

INDUSTRY



PARKS



RESIDENTS



AGRONOMY



BOTH IDEAS FOR AN URBAN PLAN WE HAVE LOOKED AD HAD THEIR ADVANTAGES AND DISADVANTAGES. BOTH NEVER REALIZED - REASON FOR THIS BEING THE FACT THAT SPACE AND RESOURCES HERE ON EARTH ARE LIMITED. HOWEVER, WHAT IF THESE IDEAS WERE TO TAKE SHAPE AND BE MADE POSSIBLE NOT HERE ON EARTH, BUT IN OUTER SPACE - WHERE THERE ARE NOT CONSTRAINS IN TERMS OF SIZE, AND RESOURCES COULD BE IN UNIMAGINABLE QUANTITIES.

WE PROPOSE A MODULAR URBAN SYSTEM, INSPIRED BY THE IDEAS OF THE GARDEN AND LINEAR CITIES THAT COULD DESIGNED TO CREATE A SELF SUSTAINABLE COLONY, AWAY FROM EARTH'S NUMEROUS BOUNDARIES.

## 1 MODULE



**INDUSTRIAL ZONE** - RECTANGULAR AREA WITH DIMENSIONS - 2KM X 4KM



**PARK ZONE** - 2 PARKS NEXT TO RESIDENTIAL WITH DIMENSIONS - 1,8KM X 4KM



**RESIDENTIAL AREA** - SQUARE WITH A SIDE 4KM AND CAPACITY 32000 PEOPLE.



**AGRICULTURAL ZONE** - RECTANGULAR AREA WITH DIMENSIONS - 2,5KM X 4KM



THESE MODULES ADOPT THE BEST QUALITIES OF THE LINEAR AND GARDEN CITY AND COMBINES THEM IN TO A NEW URBAN PLAN THAT AIMS TO:

1. CREATE A CONNECTION BETWEEN INDUSTRIAL TOWNS AND GREEN PARKS AND AGRICULTURAL AREAS
2. CLEARLY SEPARATE ZONES WHICH HAVE DIFFERENT FUNCTIONS - THUS INCREASING THEIR EFFICIENCY
3. GIVING TOWNS A SET LIMIT. WHEN REACHED NEW TOWNS WOULD BE BUILT, INSTEAD OF HOPELESSLY INCREASING THE SIZE OF THE PREVIOUS ONES.
4. MAKE NECESSARY EXPANSION ONLY IN A LINEAR, LOGICALLY DESIGNED WAY, RATHER THAN UNCONTROLLABLY
5. PROVIDE AN OPPORTUNITY FOR FAST AND EASY, PREDOMINANTLY PUBLIC, TRANSPORTATION ALONG THE LENGTH OF THE LINEAR SYSTEM
6. MEET EVERY TOWNS NEED FOR RECREATIONAL AREAS BY PROVIDING PARKS PROPORTIONATE TO THE SIZE AND POPULATION OF TOWNS.
7. MAKE EVERY TOWN SELF-SUSTAINABLE. NONETHELESS IN A GROUP THEY WOULD FUNCTION BETTER BY INCREASING THE PROVIDED OPPORTUNITIES FOR THEIR INHABITANTS. A MODULAR SYSTEM THAN CAN BE INDEPENDENTLY MODIFIED AND CHARACTERIZED WITHOUT DISRUPTING THE FUNCTION OF THE WHOLE.

KEEPING THE ABOVE MENTIONED POINTS IN MIND, THE CITY WOULD HAVE AN URBAN PLAN IN THE SHAPE OF AN ELONGATED RECTANGLE WITH A WIDTH OF 4 KILOMETRES AND THE LENGTH OF 15 KILOMETRES FOR A SINGLE MODULE. ALL OF THESE WOULD BE ARRANGED AS SHOWN BELOW. A TOWN WOULD HAVE 32 000 PEOPLE, THE FIRST COLONY WOULD BE FOR UP TO A MILLION PEOPLE.



THROUGH THE MIDDLE OF EACH ZONE WOULD RUN A SET OF RAILWAYS. THIS WOULD PROVIDE AN EASY CONNECTION THROUGH A RAPID PUBLIC TRANSPORTATION SYSTEM - DESIGNED FOR THE PARTICULAR NEED OF THE COLONY. TRANSPORTATION WOULD BE DIVIDED IN THREE, DIFFERENT IN THEIR OPERATION TRAIN NETWORKS. ONE WOULD BE DEDICATED ONLY TO SHORT DISTANCE JOURNEYS BETWEEN NEAR BY ZONES. THE SECOND ONE WOULD OFFER A FASTER CONNECTION WITH THE MAJOR POINTS IN EVERY TOWN - SUCH AS THE INDUSTRY CENTRE OR THE TOWN CENTRE. THE THIRD RAILWAY TYPE WOULD BE FOR FAST TRAVELS BETWEEN THE NUMEROUS TOWN CENTRES IN EACH SPACE STATION.



- RAILWAY 1 WITH STATIONS IN ALL SECTOR
- RAILWAY 2 WITH STATION IN ALL RESIDENTIAL AREAS AND INDUSTRIAL AREAS
- RAILWAY 3 WITH STATION ON EVERY SECOND RESIDENTIAL ZONE

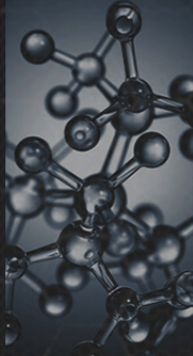
# ZONING

INDUSTRY



WITH A WORKING PLAN FOR MORE THAN ONE TOWN COMBINED IN ONE LARGE URBAN SYSTEM, WE CAN LOOK AT THE PARTICULAR CHARACTERISTICS OF EACH OF THE SEPARATE ZONES.

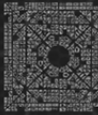
THE INDUSTRIAL ZONE IS WITH AN AREA OF 8 SQUARE KILOMETRES. THIS IS WHERE PEOPLE WILL WORK TO MAKE LIVING IN THE COLONY POSSIBLE, ENSURING ITS PROGRESS. ITS STREET NETWORK IS BASED ON A SQUARE GRID TO EASE ACCESS AND SPEED UP LINKS BETWEEN PARTS OF THE AREA. THE RAILWAY IN THE MIDDLE GUARANTEES FASTER DELIVERY OF AGRICULTURAL PRODUCTS AND RELIABLE CONNECTION TO ALL INTERMEDIATE TOWNS. THE INDUSTRIAL ZONE IS POSITIONED NEXT TO AGRONOMY LANDS, WHICH WILL ESTABLISH A STRONG LINK BETWEEN THE TWO, PLUS A LOT OF TIME AND ENERGY WILL BE SAVED FROM TRANSPORTATION OF GOODS.



PARKS



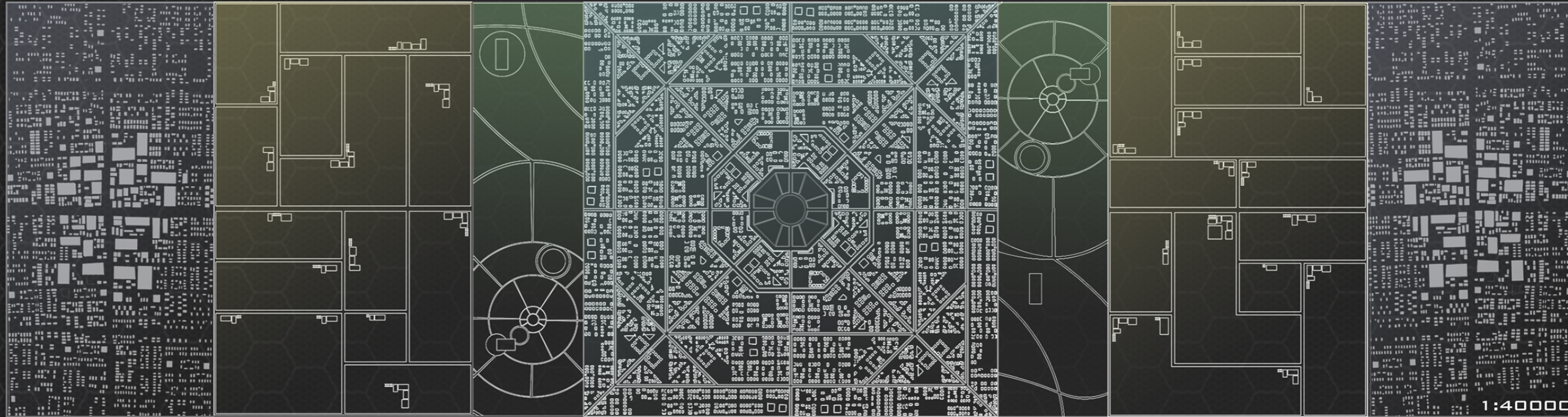
RESIDENTS



AGRONOMY



THE RESIDENTIAL ZONES HAVE AN AREA OF 16 SQUARE KM. WITH A POPULATION DENSITY OF 2000 PEOPLE PER SQUARE KM IT PREVENTS THE RISK OF OVERPOPULATION AND IT PROVIDES A HEALTHY AND CALM ENVIRONMENT. IN THE CENTRE, AROUND A SMALL PARK, ARE ALL ADMINISTRATIVE BUILDINGS SUCH AS POLICE DEPARTMENT, HOSPITALS, CITY HALLS, ECT. THEY ARE LOCATED IN THE CENTRE FOR FAST REACTION IN EMERGENCIES AND EASY ACCESS FOR CITIZENS. STREET NETWORK IS RECTANGULAR AND SYMMETRICAL - EASY FOR PEOPLE TO NAVIGATE THROUGH. DIAGONALS ACT AS A DIRECT CONNECTION TO THE TOWN CENTRE. THIS ZONE IS LIMITED - DESIGNED FOR A MAXIMUM OF 32000 PEOPLE. THIS MEANS THAT THE NUMBER OF PEOPLE LIVING IN EACH COLONY IS SET. IN ORDER TO GROW, NEW COLONIES HAVE TO BE BUILT, NOT EXPAND PREVIOUS ONES.

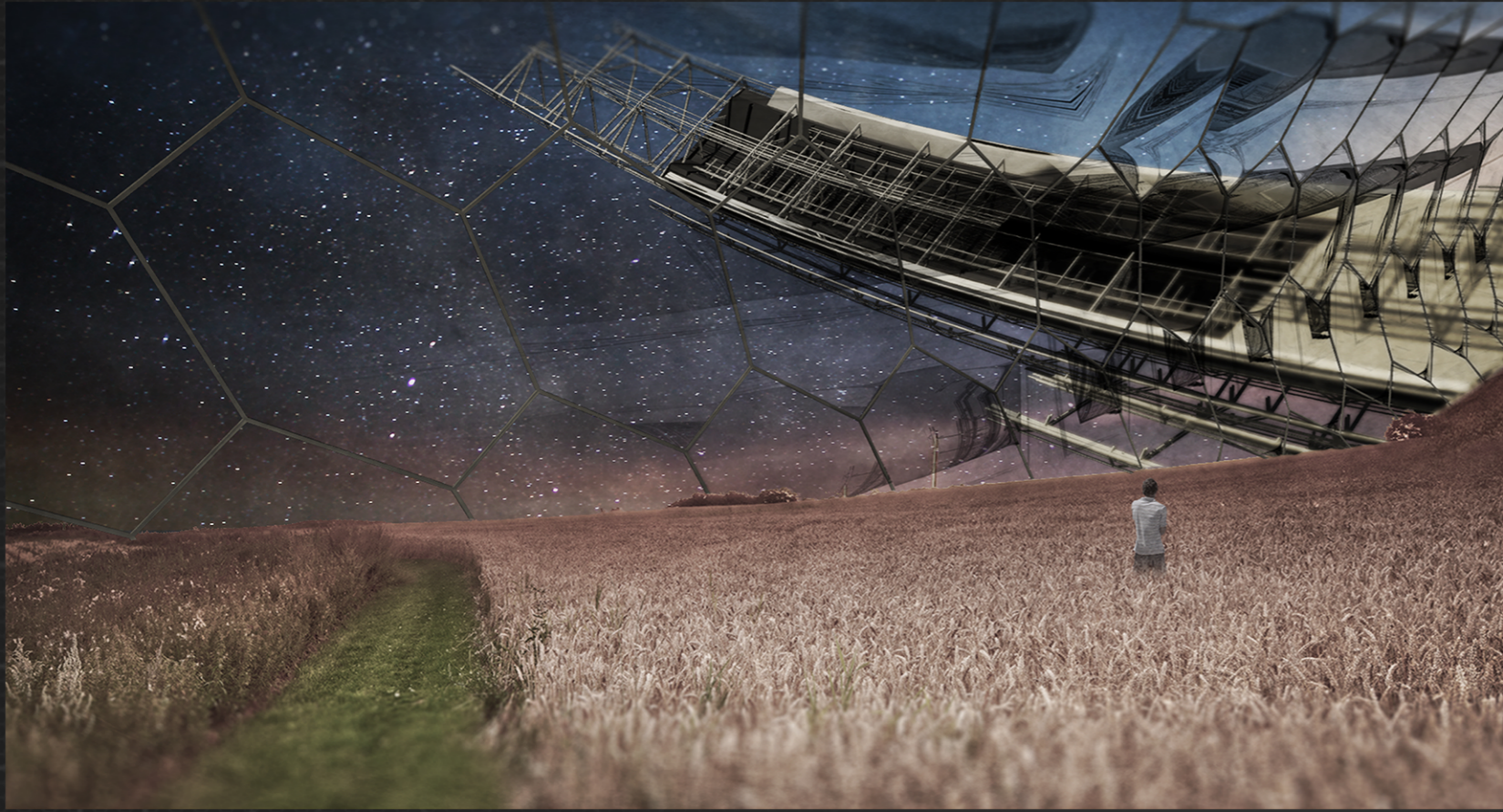


PARK ZONES ARE IMPORTANT PART OF THE SYSTEM. THEY PROVIDE FRESH AIR FOR THE COMPLEX AND ALSO TRANQUILITY FOR CITIZENS, WHICH IS ESSENTIAL FOR MANY TYPES OF PUBLIC BUILDINGS LIKE SCHOOLS, UNIVERSITIES, LIBRARIES, MUSEUMS, EST. ALL THOSE BUILDINGS WOULD BE SITUATED IN THE PARK IN EASILY ACCESSIBLE AREAS. PEDESTRIAN LANES ARE ARRANGED IN A LESS GEOMETRICALLY STRICT PATTERN. EACH RESIDENTIAL ARE IS FRAMED BY TWO RECREATIONAL AREAS.



THE AGRICULTURAL LAND HAS AN AREA OF 10 SQUARE KM. WITH TWO SERVING 1 RESIDENTIAL AND 1 INDUSTRIAL ZONES. THIS IS A VITAL ELEMENT OF THE TOWN, AS IT IS WHAT SUSTAINS IT AND RENDERS IT SELF-SUFFICIENT. WITH A SMALL, DEDICATED TO THE NEEDS OF THE TOWN AGRICULTURAL AREA, PEOPLE ARE OFFERED THE BENEFITS OF LIVING IN THE COUNTRY SITE, WITH OF COURSE THE OPPORTUNITIES OF THE INDUSTRIAL SECTOR STILL AVAILABLE.

# GLIMPSE OF THE FUTURE



A HABITAT IN OUTER SPACE WOULD CREATE A MAN MADE WORLD LIKE NO OTHER. VIEWS THAT SEEM POSSIBLE ONLY IN DREAMS COULD ONE DAY BECOME REALITY. THIS IS A VISION OF A SELF SUSTAINABLE WORLD THAT MAKES LIVING IN OUTER SPACE NOT ONLY POSSIBLE, NOR JUST AS GOOD AS LIFE ON EARTH - BUT MAYBE EVEN BETTER. THE PROJECT AIMS AT DARING PEOPLE TO DREAM, AND THINK BIG.



# FORM AND GRAVITY STUDY

WITH A WORKING URBAN PLANS BASED ON THE IDEAS OF EBENEZER HOWARD AND ARTURO SORIA WE CAN TURN TO THE GREAT CHALLENGES, THAT BUILDING SUCH A SYSTEM IN SPACE PRESENTS, AND THE WAYS THEY CAN BE SOLVED.

ONE OF THE BIGGEST PROBLEMS THAT HUMANS FACE WHEN LIVING IN SPACE IS THE LACK OF GS (ACCELERATION FELT AS WEIGHT) ON THEIR BODIES. STAYING IN SUCH A WEIGHTLESS ENVIRONMENT CAN CAUSE LONG TERM HARM TO THE HUMAN BODY. SOME OF THE GREATEST ISSUES ARE MUSCLE ATROPHY, BONE DENSITY DECREASE AND WEAKENING OF THE IMMUNE SYSTEM. SO, FOR HUMANS TO THRIVE IN SPACE, PROVIDING THEM WITH ARTIFICIAL GRAVITY, IS ESSENTIAL.

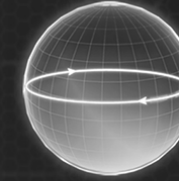


MANY WAYS OF CONSTRUCTING SPACE CRAFTS WITH ARTIFICIAL GRAVITY HAVE BEEN EXPLORED THROUGHOUT THE YEARS, BUT NONE HAVE EVER BEEN BUILT. NASA PROJECTS (STANFORD TORUS) THAT DATE AS FAR BACK AS THE 1970 HAVE STUDIED THE POSSIBILITY, OF ONE DAY, BUILDING A LARGE SCALE, RING - SHAPED SPACE COLONY.



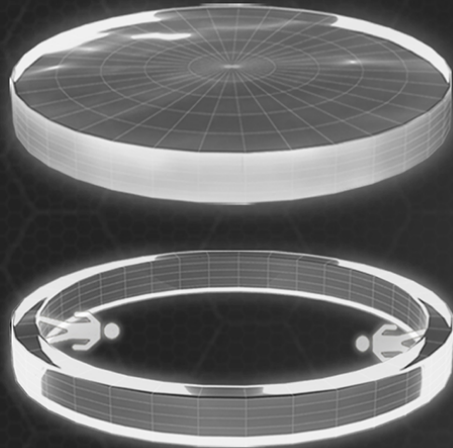
CENTROFUGAL FORCE

TO PROVIDE ARTIFICIAL GRAVITY, THE STATION HAS TO GIVE ITS INHABITANTS THE SENSE OF WEIGHT OR G - ACCELERATION. THIS IS POSSIBLE THROUGH THE USE OF THE CENTRIFUGAL FORCE.



GRAVITY ONLY ALONG EQUATOR.

WHEN A VOLUME ROTATES, EVERYTHING INSIDE IT WOULD BE PUSHED OUTWARDS, AGAINST ITS INNER WALLS, ENFORCING GRAVITATIONAL FORCES ON IT. THE FASTER IT ROTATES, OR THE BIGGER IT IS, THE HIGHER THE CENTRIFUGAL FORCE WILL THE OBJECTS FEEL.



A SPHERE CAN BE FLATTENED TO A CYLINDER, AND WOULD PROVIDE JUST AS MUCH OF AN AREA WITH GRAVITATIONAL PULL TOWARDS IT. HOWEVER, THE OBJECT'S SPEED, OR ACCELERATION, AND THUS GRAVITY IS RELEVANT TO ITS DISTANCE FROM THE CENTER OF ROTATION. SO RIGHT IN THE MIDDLE OF THE CYLINDER ONE WOULD AGAIN BE IN WEIGHTLESS CONDITION. FOR THAT REASON THE GEOMETRY CAN BE REDUCED TO A CARVED OUT CYLINDER.



0.5 REVOLUTIONS PER HOUR

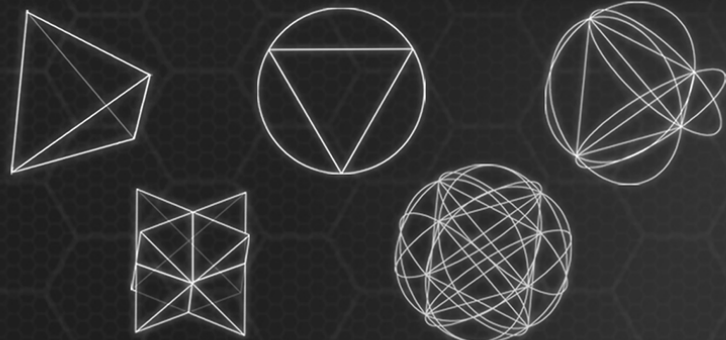
BECAUSE A SPHERE HOLDS THE LARGEST VOLUME WITH THE SMALLEST SURFACE AREA, THE MOST EFFICIENT SHAPE OF THIS KIND WOULD BE A TORUS. THE FIRST TORUS WOULD HAVE A 50KM FIRST RADIUS AND ITS SPHERE WOULD BE WITH THE DIAMETER OF 4 KM. WITH SUCH DIMENSIONS THE STATION WOULD HAVE TO ROTATE ONCE EVERY TWO HOURS TO PROVIDE ITS INHABITANTS WITH THE SAME GRAVITATIONAL FEEL AS THAT ON EARTH.



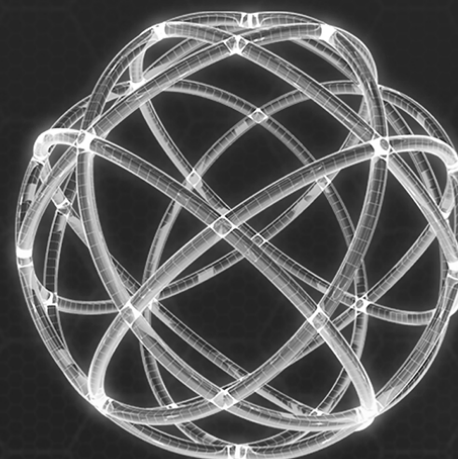
TO ALLOW FOR SUCH A ROTATION OF THE VAST SPACE STATION, IN THE WEIGHTLESS ENVIRONMENT OF SPACE, A TEMPORARY COUNTERWEIGHT WOULD BE NECESSARY. THIS COUNTERWEIGHT IN THE FORM OF AN ASTEROID WOULD BALANCE THE DIFFERENCE IN WEIGHT BETWEEN THE TORUS AND THE ROTATION SYSTEM.



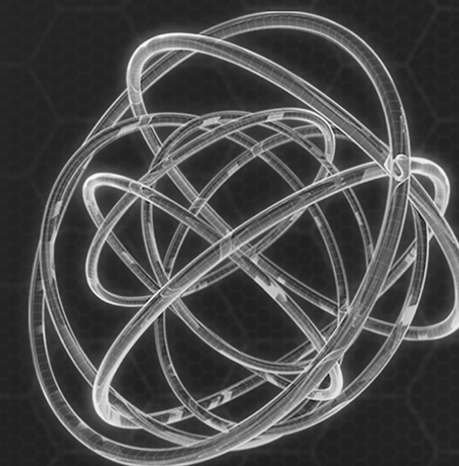
KEEPING THE CONCEPT OF GROWTH AND EXPANSION, IN THE FUTURE MORE RINGS WOULD BE, IN A PREDETERMINED WAY, ADDED TO THE SYSTEM. EACH WOULD ROTATE IN A DIRECTION OPPOSITE FROM THE PREVIOUS ONE - REDUCING THE SYSTEM'S ANGULAR MOMENTUM. AFTER THE CONSTRUCTION OF THE SECOND RING A COUNTERWEIGHT WOULD BE NO LONGER NECESSARY.



THIS WOULD BE INFORMED BY THE GEOMETRY OF THE TETRAHEDRON (THE STIFFEST STRUCTURE). EACH NEXT TORUS WOULD BE DESCRIBED AROUND ONE OF THE PYRAMID'S FACES.



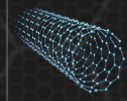
THIS IS A HIGHLY EFFICIENT SYSTEM FOR THE MULTIPLE MODULES AS IT, JUST LIKE THE TETRAHEDRON'S EDGES, DISTRIBUTES THE RINGS EVENLY THROUGH SPACE. WITH EXACTLY 3 HAVING A COMMON POINT THEY CONTRIBUTE FOR THE COLONY'S STABILITY IN EVERY AXIS IN ALL 3 OF SPACE'S DIMENSIONS. EACH RING WOULD HAVE A PARALLEL ONE -DIRECTLY CANCELING EACH OTHER'S ANGULAR MOMENTUM.



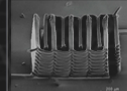
ROTATION WOULD BE ACHIEVED THROUGH THE USE OF ENGINES AND GEARS, POSITIONED ON THE RINGS' OUTER FRAME. BY KEEPING THEIR CENTERS FREE STATIONS CAN INTERACT AND EXPAND IN ALL 3 DIMENSION. EACH RING BEING 8.3% WIDER THAN THE PREVIOUS ONE.

# TECHNOLOGICAL INNOVATIONS

NANO TUBES



3D PRINTING



EDEN PROJECT



SOLAR PANELS



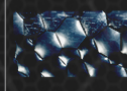
LONDON EYE



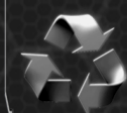
CARBON FIBER



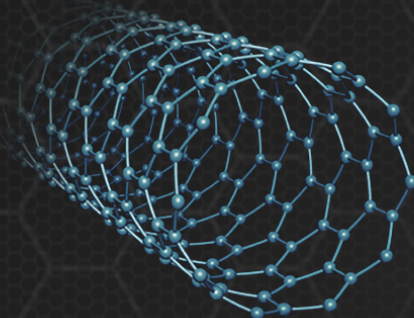
ETFE PILLOWS



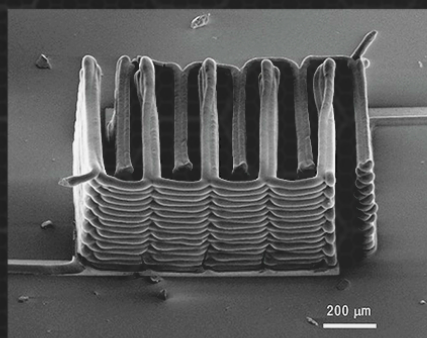
RECYCLING



ALTHOUGH SPACE STATIONS OF SUCH SIZE AND SCOPE HAVE NEVER BEEN BUILT, HUMANITY IS WELL ON ITS WAY OF DEVELOPING TECHNOLOGIES THAT COULD ONE DAY BE THE BUILDING BLOCKS OF SUCH A CONSTRUCTION.



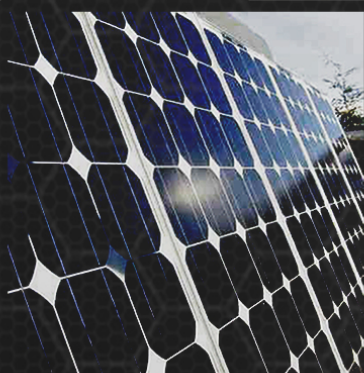
GRAPHENE IS ONE OF THE NEWEST INVENTED MATERIALS. MADE OUT OF ATOMS ARRANGED IN HEXAGONAL PATTERN IT IS ULTRA-THIN AND LIGHT - WITH STRENGTH UNITS 100 TIMES HIGHER THAN THOSE OF STEEL. IT CAN BE USED TO MAKE CARBON NANOTUBES WHICH ALONG WITH GRAPHENE COULD BE THE BUILDING MATERIALS OF THE FUTURE. GRAPHENE CAN BE USED IN ADDITION TO OTHER MATERIALS TO FURTHER STRENGTHEN THEM.



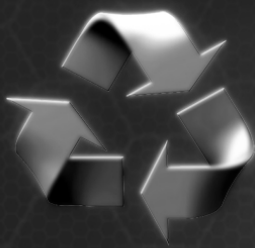
3D PRINTING IS A PROCESS OF MAKING 3D SOLID OBJECTS FROM A DIGITAL MODEL. THERE ARE PROJECT FOR USING 3D PRINTERS IN SPACE FOR CREATING A VARIETY OF OBJECTS - FROM COMPUTER COMPONENTS TO SCIENTIFIC EQUIPMENT. THIS CAN ONE DAY LEAD TO TAKING NOT FINISHED PRODUCTS , BUT A WHOLE INDUSTRY, EASILY CREATING OBJECTS, UP IN SPACE. HIGHLY EFFICIENT NANO BATTERIES HAVE BEEN RECENTLY DEVELOPED, USING THIS METHOD.



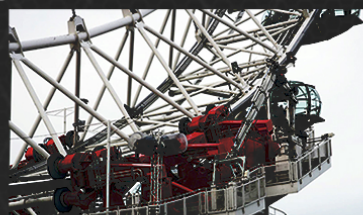
EDEN PROJECT IS AN ATTRACTION IN CORNWALL, UK. THE COMPLEX CONSISTS OF DOMES WHICH CREATE ARTIFICIAL BIOMES. IN THOSE DOMES ARE COLLECTED MANY PLANTS FROM ALL OVER THE WORLD. THE EDEN PROJECT PROVES HUMAN'S CAPABILITY OF BUILDING ARTIFICIAL SELF-SUSTAINABLE ENVIRONMENTS.



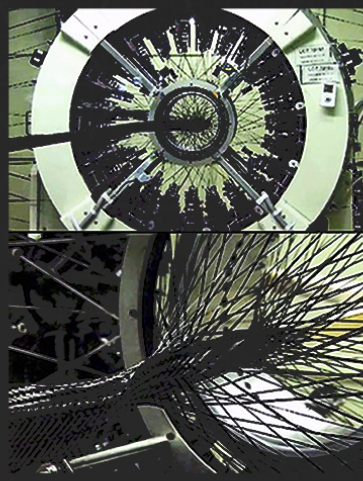
SOLAR PANELS CONVERT THE LIGHT'S ENERGY DIRECTLY INTO ELECTRICITY. WITH RAPID GROWTH IN EFFICIENCY SOME OF THEM NOW HAVE HIGHER THAN 44% RATES, WHICH COULD KEEP GROWING IN UPCOMING YEARS.



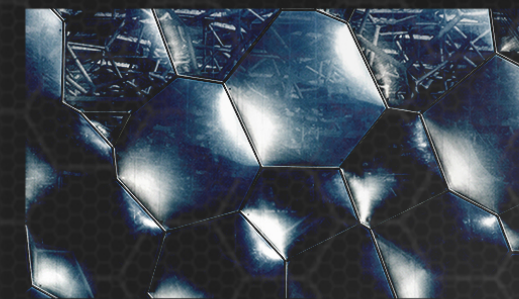
CLOSED RECYCLING CIRCLE. USING ONLY RECYCLING MATERIALS AND BIO WASTED TURNED IN TO FERTILISER



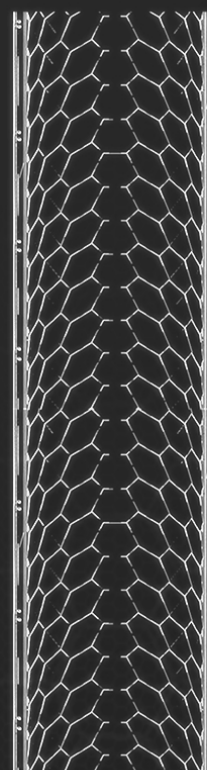
THE LONDON EYE USES A MECHANISM AT ITS BASE, NOT ITS CENTER, TO ROTATE. THE CENTER OF THE FERRIS WHEEL SERVES ONLY TO SUPPORT THE STRUCTURE. A TORUS SHAPED STATION COULD BE ROTATED, IN A SIMILAR WAY



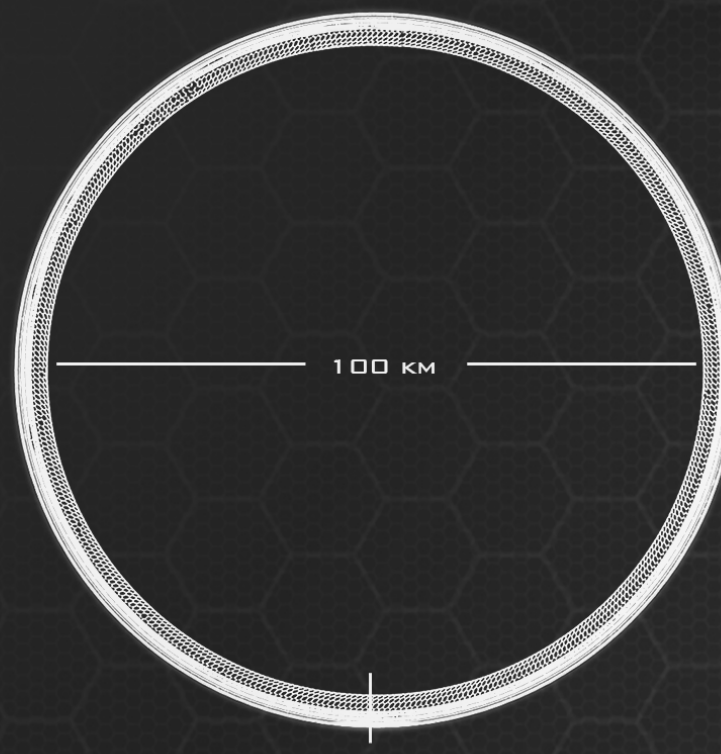
IN SPACE THERE ARE EXTREME CONDITIONS. CARBON FIBER IS A MATERIAL CONSISTING OF FIBER ABOUT 5-10 μm IN DIAMETER AND COMPOSED MOSTLY OF CARBON ATOMS. IT HAS STIFFNESS, HIGH TENSILE STRENGTH, LOW WEIGHT, HIGH TEMPERATURE TOLERANCE AND LOW THERMAL EXPANSION AND THAT MAKE IT PERFECT FOR FRAMEWORK FOR ETFE AND IT CAN RESIST THE EXTREME CONDITIONS IN SPACE. WITH MODERN MACHINES IT CAN BE WEAVED IN A GREAT VARIETY OF SHAPES AND SIZES.



ETFE (ETHYLENE TETRAFLUOROETHYLENE) IS A HIGHLY TRANSPARENT POLYMER PLASTIC WITH VERY HIGH MELTING TEMPERATURE, EXCELLENT CHEMICAL, ELECTRICAL, AND HIGH ENERGY RADIATION, RESISTANCE PROPERTIES. IT IS USED IN MANY MODERN BUILDING AND STRUCTURES(EDEN PROJECT). IT CAN BE THREATED TO BE PROTECTIVE AGAINST UV RAYS AND SOLAR RADIATION IN SPACE.

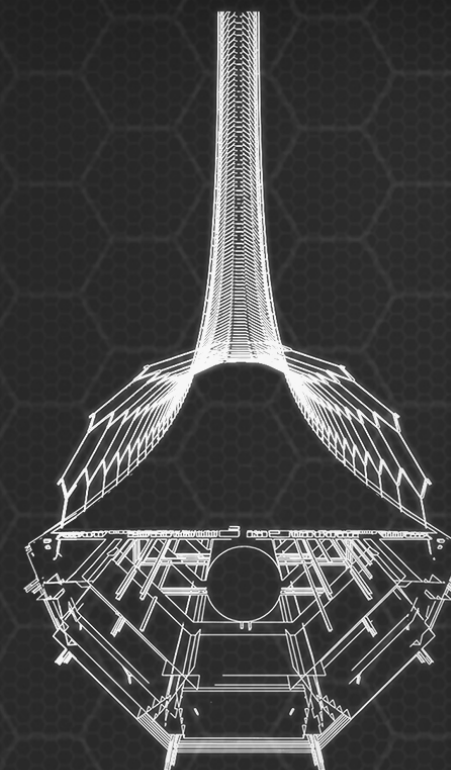


INSIDE FRAME PATTERN



100 KM

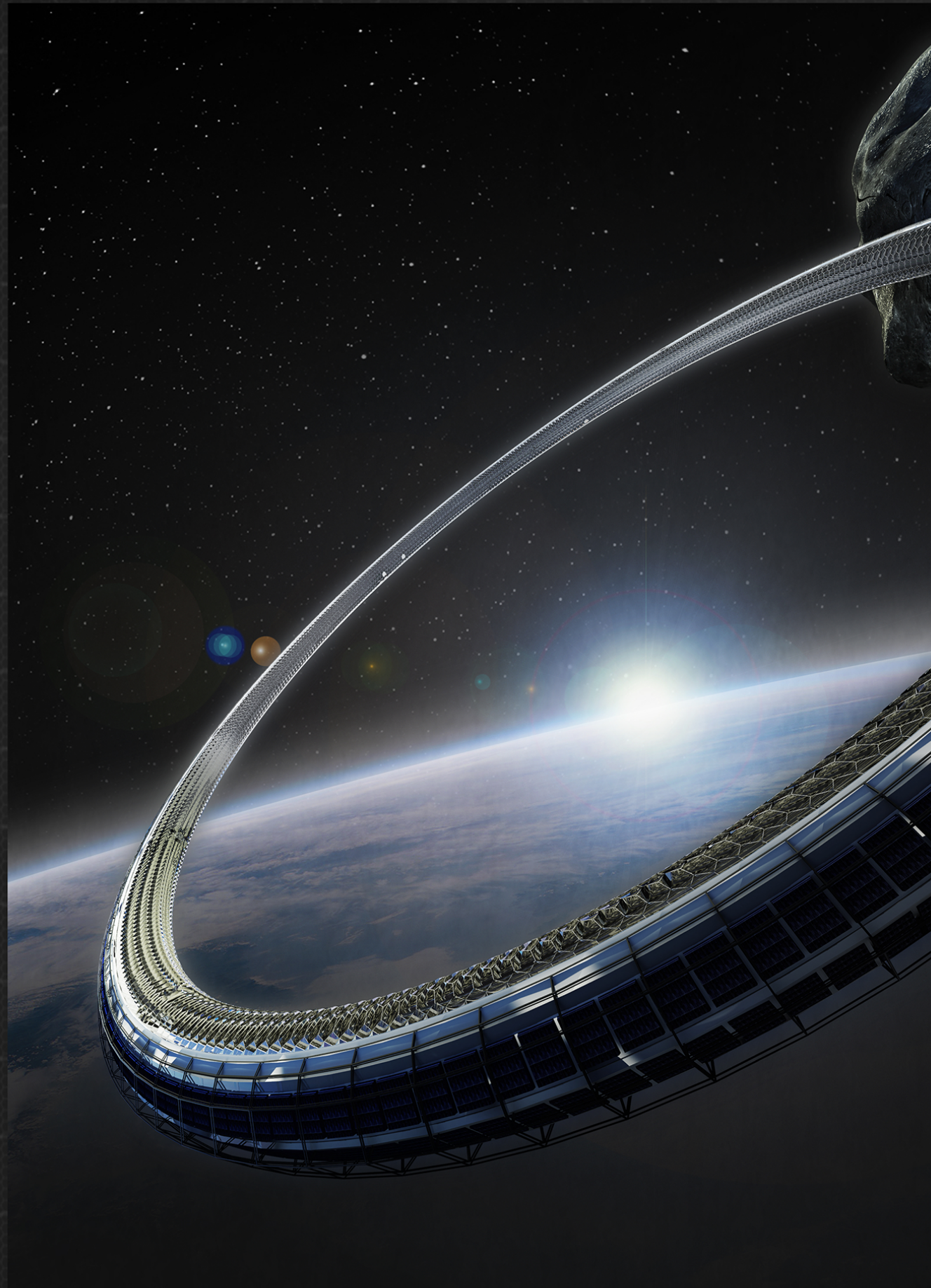
4KM



PERSPECTIVE SECTION

COMBINING ALL OF THESE TECHNOLOGIES, PRINCIPLES, AND MATERIALS, A SPACE STATION OF THIS TYPE COULD POSSIBLY BE BUILT IN THE NOT SO DISTANT FUTURE - SETTING A MILESTONE IN HUMAN EVOLUTION AND EXPANSION





FIRST RING UPON COMPLETION



SECOND RING IN CONSTRUCTION

# CONSTRUCTION

OUTER FRAME

SERVICE CORES

INNER SKIN

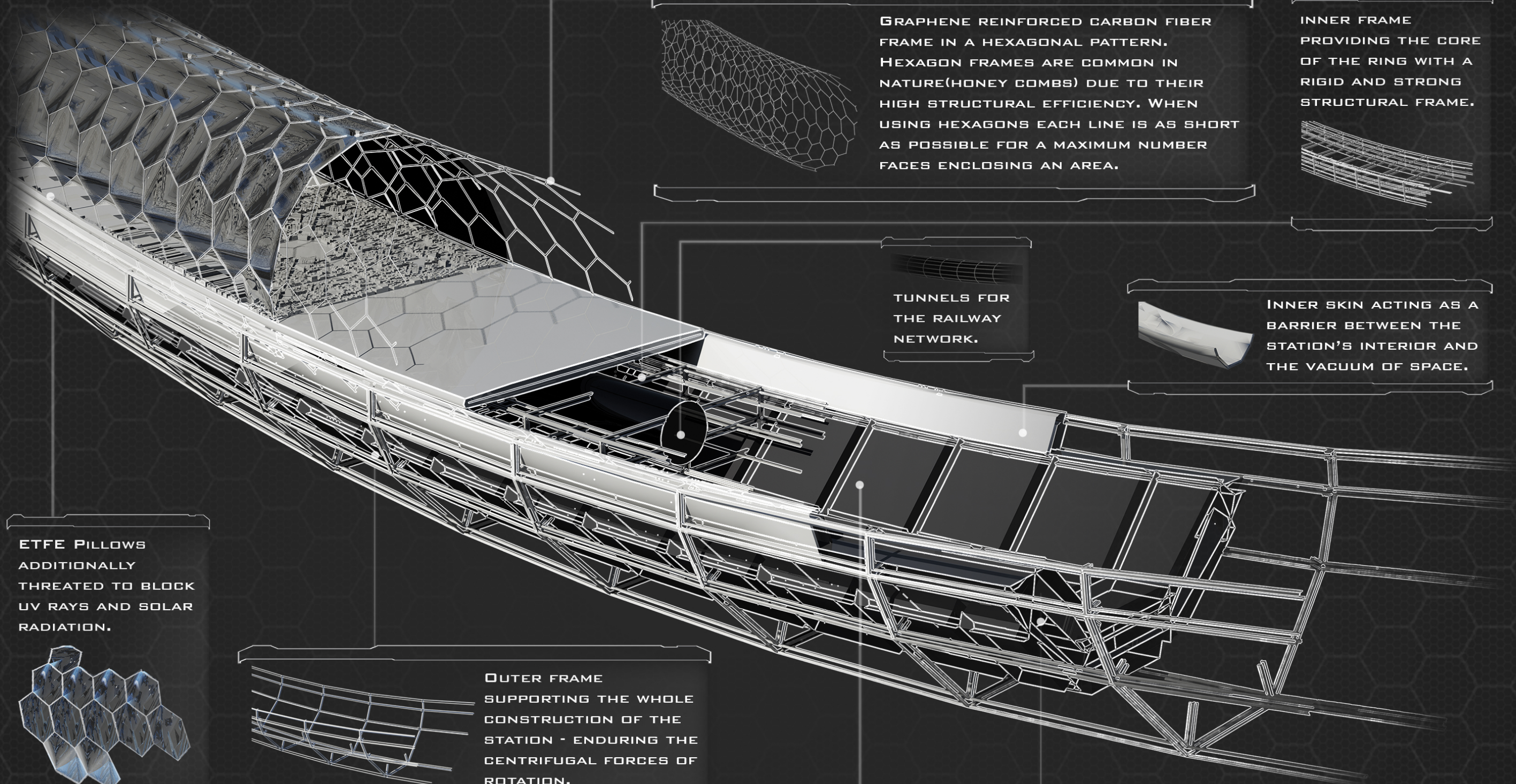
INNER FRAME

TRAIN TUNNELS

HEXAGON FRAME

ETFE PILLOWS

SOLAR PANELS



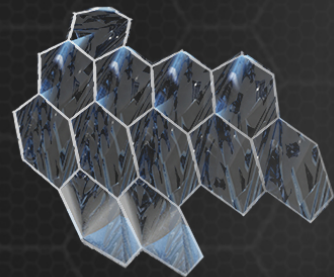
GRAPHENE REINFORCED CARBON FIBER FRAME IN A HEXAGONAL PATTERN. HEXAGON FRAMES ARE COMMON IN NATURE (HONEY COMBS) DUE TO THEIR HIGH STRUCTURAL EFFICIENCY. WHEN USING HEXAGONS EACH LINE IS AS SHORT AS POSSIBLE FOR A MAXIMUM NUMBER FACES ENCLOSING AN AREA.

INNER FRAME PROVIDING THE CORE OF THE RING WITH A RIGID AND STRONG STRUCTURAL FRAME.

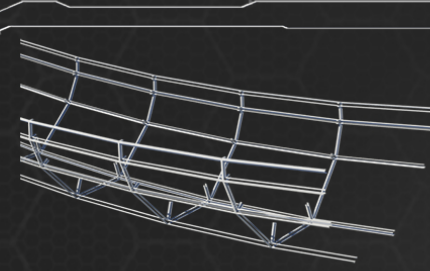
TUNNELS FOR THE RAILWAY NETWORK.

INNER SKIN ACTING AS A BARRIER BETWEEN THE STATION'S INTERIOR AND THE VACUUM OF SPACE.

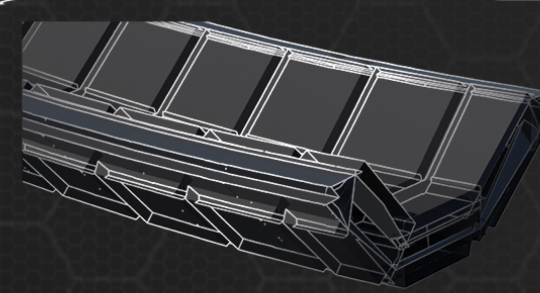
ETFE PILLOWS ADDITIONALLY THREADED TO BLOCK UV RAYS AND SOLAR RADIATION.



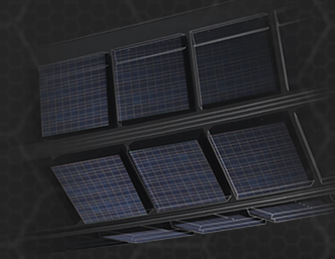
OUTER FRAME SUPPORTING THE WHOLE CONSTRUCTION OF THE STATION - ENDURING THE CENTRIFUGAL FORCES OF ROTATION.

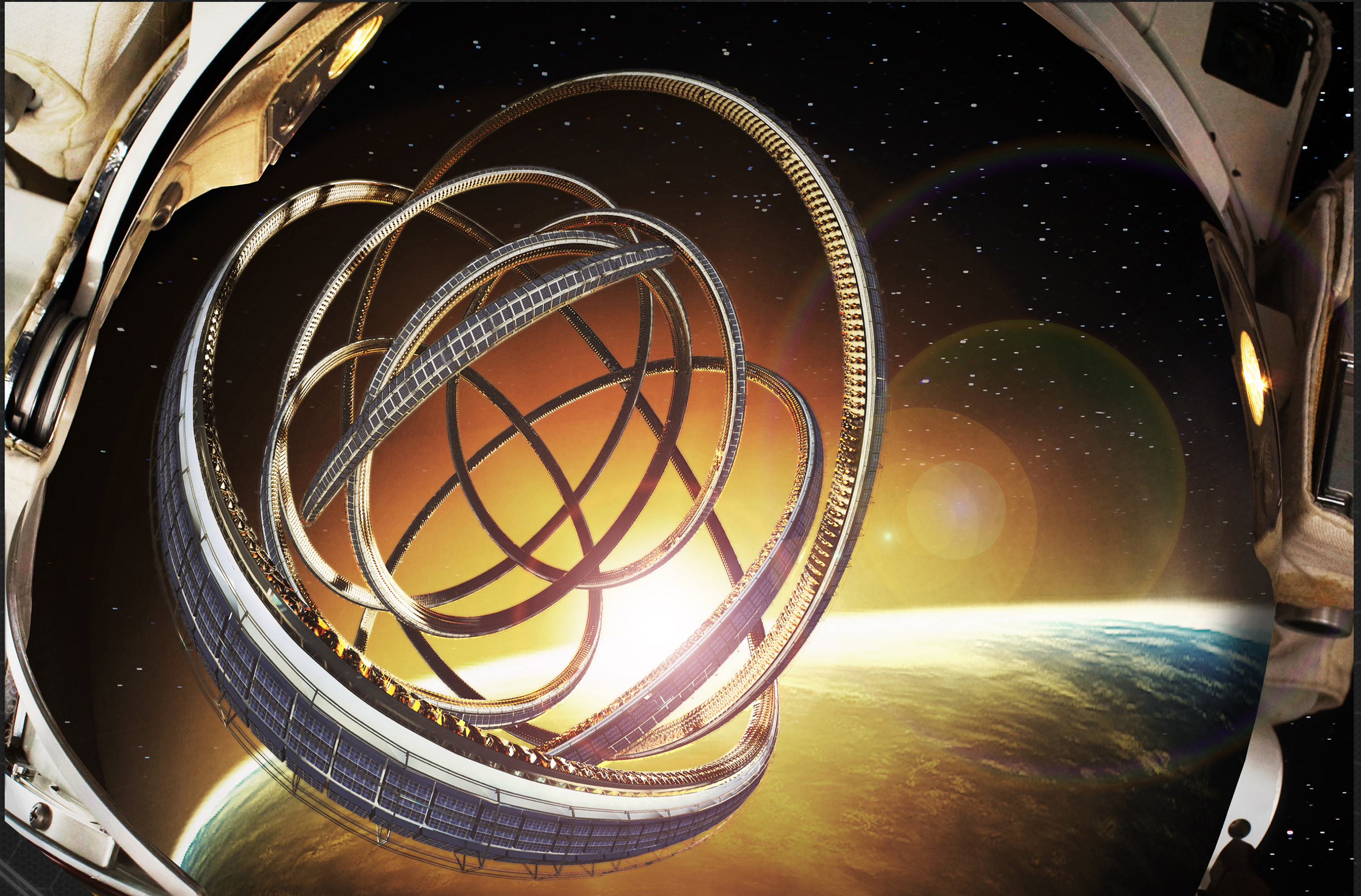


FOR THE STATION TO BE CONSTANTLY OPERATIONAL, IT WILL HAVE TO STORE SOME OF THE POWER ACQUIRED BY THE SOLAR PANELS. THIS COULD BE MADE POSSIBLE THROUGH THE USE OF LARGE BATTERIES IN THE INSIDE OF THE RING. THEY WILL BE PART OF THE SERVICE CORES THE PURPOSE OF WHICH IS TO ENSURE THE STATION FUNCTIONS ACCORDINGLY.



HIGH EFFICIENCY SOLAR PANELS ON THE OUTER SIDE OF THE TORUS POWERING THE WHOLE STATION.







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 "INNOVATION AND ARCHITECTURE FOR THE SEA"  
 "INNOVATION AND ARCHITECTURE FOR SPACE"  
 "ARCHITECTURE & SEA LEVEL RISE"

**LEGAL WAIVER**

I undersigned Deyan Saev  
 For the project team Deyan Saev and Nguyen Son

Candidate to the 2013 edition of	THE JACQUES ROUGERIE FOUNDATION "Innovation and Architecture for the Sea" Award*	
Candidate to the 2013 edition of	THE JACQUES ROUGERIE FOUNDATION "Innovation and Architecture for Space" Award*	✓
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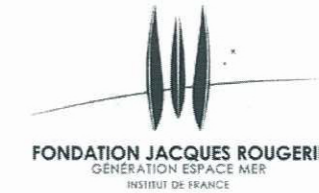
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IN read and approved ON THE 1.10.2013  
 To write "read and approved"  
 \*please tick

Signature



PRIZES OF THE JACQUES ROUGERIE FOUNDATION  
 "INNOVATION AND ARCHITECTURE FOR THE SEA"  
 "INNOVATION AND ARCHITECTURE FOR SPACE"  
 "ARCHITECTURE & SEA LEVEL RISE"

**LEGAL WAIVER**

I undersigned NGUYEN SON  
 For the project team DEYAN SAEV AND NGUYEN SON

Candidate to the 2013 edition of	THE JACQUES ROUGERIE FOUNDATION "Innovation and Architecture for the Sea" Award*	
Candidate to the 2013 edition of	THE JACQUES ROUGERIE FOUNDATION "Innovation and Architecture for Space" Award*	✓
Candidate to the 2013 edition of	THE JACQUES ROUGERIE FOUNDATION "Architecture & Sea Level Rise" Award*	

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IN READ AND APPROVED ON THE 01.10.2013  
 To write "read and approved"  
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