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The 3rd AIAA LA-LV Space Architecture Gathering

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URBAN FARMING FOR EXTREME ENVIRONMENTS ON MARS





SIMOC MISSION CONFIGURATION

Location:	Mars	Greenhouse:	5610m ³
Duration:	730 Days	Solar PV Array:	5000
Inhabitants:	9	Batteries:	10000 kwh
Food:	6000 kg	ECLSS:	5
Crew Quarters:	1000 m ³		

Agiculture is the most destructive human activity on the planet. Planet Earth has only 60 years of farmable land left due to unsustainable agriculture and extreme weather conditions. In USA alone the soil rate is at a loss of 10x it takes to generate it. The AACT algae aqua culture technology in conjunction with the pyrolysis process machines will heat bio waste at 1000 degrees Fahrenheit and in absence of oxygen will produce biochar a product that locks in carbon and creates an environment for soil microbes to breed in. As a waste bioproduct of this, we will have huge excess energy to be stored in batteries and methane sent back to process more waste in a perfect closed circle. Biodiversity is necessary, the imbalance as seen by all calls for fertilisers and pesticides to combat super weeds and super insects, health issues for consumers, destruction. The green power house is the solution moving forward as it will be able to absorb all the carbon in the terrestrial atmosphere and resolve global warming while accelerating soil generation from decades to days and turning waste into energy. Why is this not implemented everywhere already?

STEP 1

ISRU - IN SITU RESOURCE UTILISATION.

Science thoroughly sustains that extreme temperatures and radiations present on Mars surface will nullify almost all attempts of the structures proposed thus far for habitation and greenhouses due to the extreme cold and deeply penetrating ionising solar and cosmic radiation both of which would have severe consequences for plants and inhabitants. The solution commences with materials that are harvested directly from the martian surface via ISRU (in-situ resource utilisation) to create a powerful shield against the martian surface until it is terraformed. AI extractors will head towards the mapped sites of smectite at the delta of the ancient river bed. Other AI extractors will proceed to extract the basalt fibers closely from the martian rock of the crater which with its own tensile strength will be combined with renewable bioplastic. The key material to produce to make plastic is the production of Ethylene, which is C2H4 produced by the reaction of 2CO + 4H2 = C2H4 + 2H2O with the presence of an iron catalyst. The carbon monoxide comes from 6H2+2CO2=2H2O+2CO+4H2 hence the key to making plastics is carbon dioxide & water. This renewable bio plastic together with the basalt fibers will form basalt fiber reinforced plastic, a highly insulative material. Creating bio plastics from plants will also be possible but only at a later phase when flourishing greenhouses are established from which to derive it from.

STEP 2

STRUCTURES - CMB (COMPRESSED MARS BLOCKS) AND 3D PRINTING.

AI will dig site trenches for foundations and commence the 3d printing in basalt fiber reinforced plastic of the Green Power House geothermal foundation and pools to include 6 algal raceways for algae aquaculture technology and house the bioprocessors with the photosynthetic collector cells. Compressed Mars bricks will be microwaved and locked together without mortar to form walls for the central core green power house building. After completion of the central core walls and six armed walled structure, the walls will be covered with six 3d printed basalt nuban vaults at an angle of 40 degrees.

Nuban vaults do not necessitate of any scaffold and are perfect for AI guided construction remotely. Extracted silica will be shaped into glazing to close each end of the Nuban vaults. The 3d printing will proceed to the lower out wall arms that will house the ISS greenhouse cylinders and habitations. The lower walls will support a series of Nuban vaults each capped with a glazing lid, each to correspond to one ISS greenhouse cylinder it houses. Each ISS greenhouse cylinder has skylights that will receive light from the nuban vault end glazing above it. All plants will also be receiving ample light from the LEDs aligned from the solar collectors.

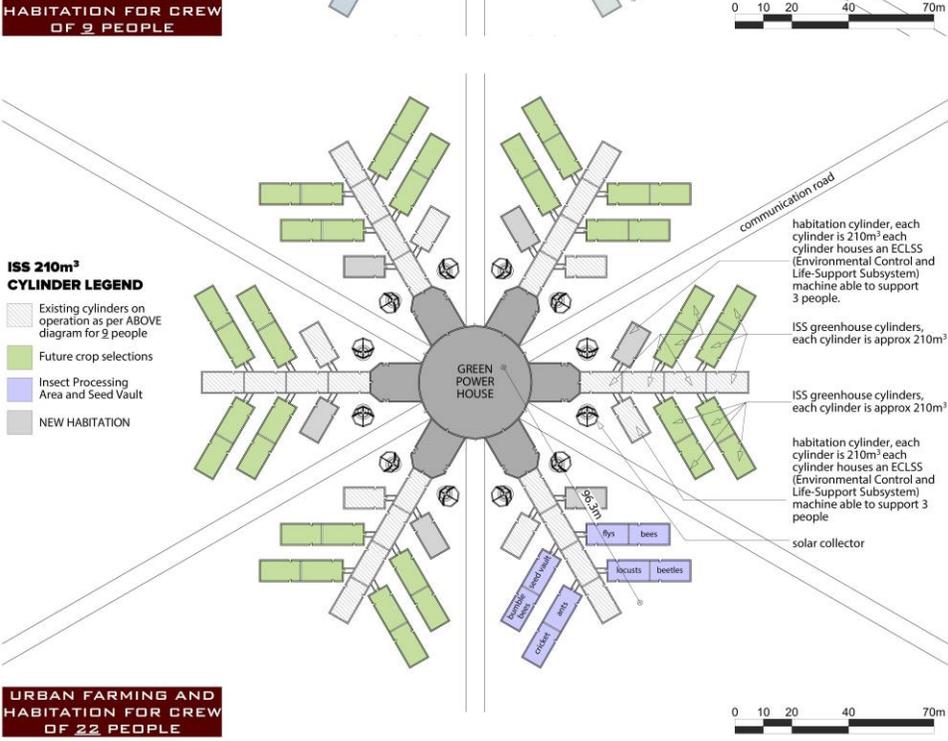
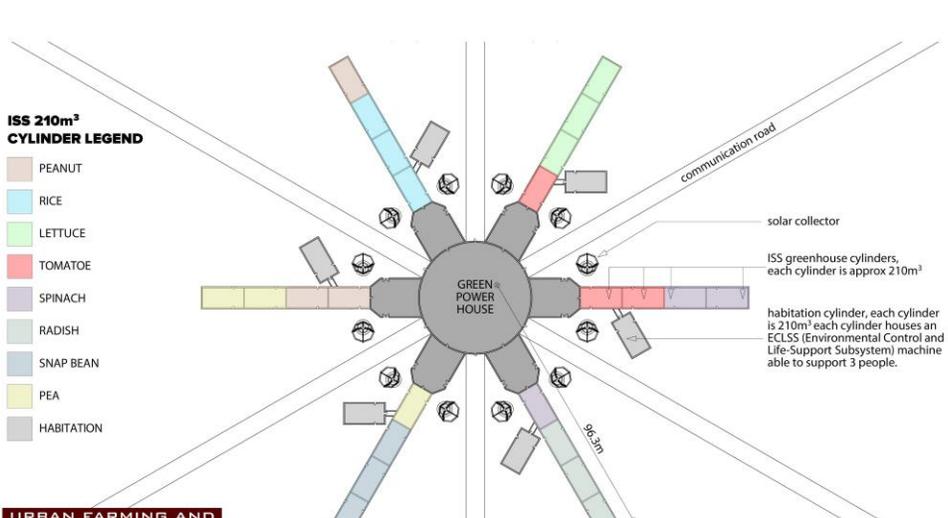
STEP 3

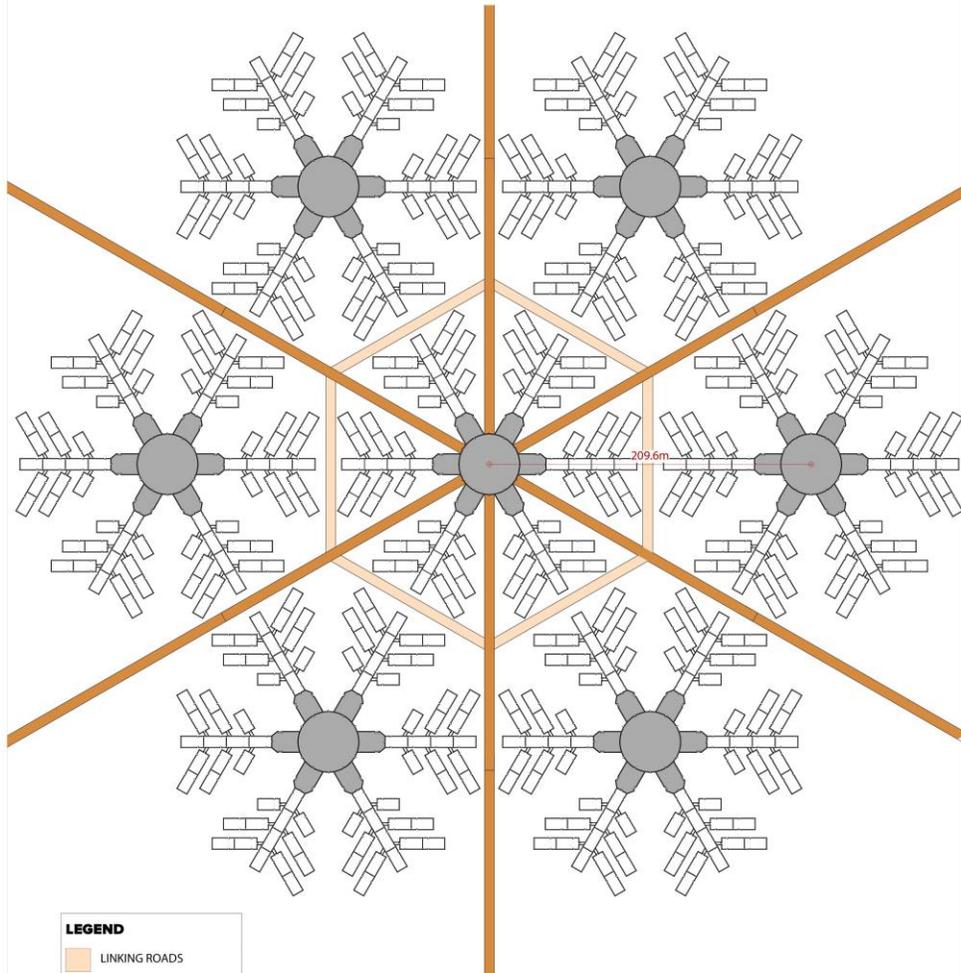
GREEN POWER HOUSE AND GREEN HOUSE CYLINDERS.

The ISS cylinders will work together with a revolutionary system already applied with great success on planet Earth by Michael Smith which is referenced called the Green Power House, this system mimics natural biological processes that have been around for a very long time. The GPH Green Power House is an integration of three sub components: ABR: Anaerobic Bioreactors /PBR: Photo Bioreactors/OCE: Organic Carbon Engine that work together to convert waste by products from other agricultural, municipal, industrial and silvicultural processes into energy and soil amendments. ABR Anaerobic Bioreactors convert algal biomass into methane, hydrogen and organic fertilizer. PBR Photo Bio Reactors are designed for growing algae in large algal raceways. When ready, the PBR Photo Bioreactors move the algae to the reactor core where it is concentrated and prepared for transfer into an anaerobic bioreactor where it gets converted to organic fertilizer and fuel. Finally the OCE the Organic Carbon Engine, a biomass powered device that generated syngas, bio oil and biocarbon also called biochar, any residual heat is converted back into the Green Power House system for the cultivation of algae and its conversion into organic fertiliser and fuel.

STEP 3

ACT algae aqua culture technology system will produce methane, hydrogen and bio-oils that can be used as fuel for farm and industrial equipment or to generate electrical power. As the system produces no waste, its byproducts are valuable high grade organic fertilizer & soil amendments. The Green Power House is a self sustaining, self managing greenhouse that can be used for the year round production of organic food in virtually any climate with both Earth and Mars applications. Once the structure is completed the ISS greenhouse cylinders seeds will be activated and crops will grow and flourish while humans have departed from Earth. At their arrival waste from plants and their consumption will be fed in the Green Power House system.



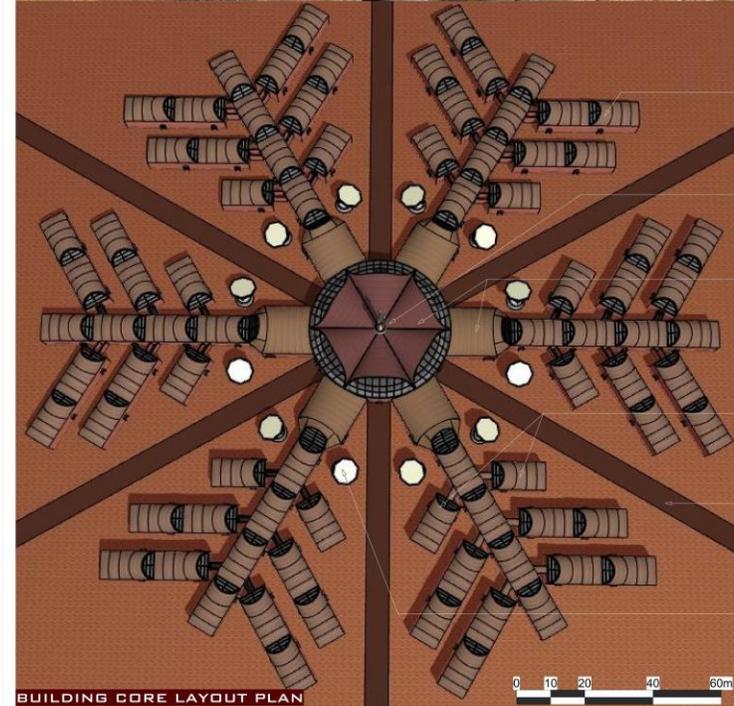


LEGEND
 LINKING ROADS
 COMMUNICATION ROADS

URBAN FARMING AND HABITATION FOR CREW OF 154 PEOPLE



JEZERO CRATER SITE LAYOUT PLAN



BUILDING CORE LAYOUT PLAN

NUBIAN VAULTS OVER CMB
BLOCK WALLS WILL SCREEN
ISS GREENHOUSE CYLINDERS
FROM IONIZING SOLAR,
COSMIC RADIATION AND
EXTREME COLD

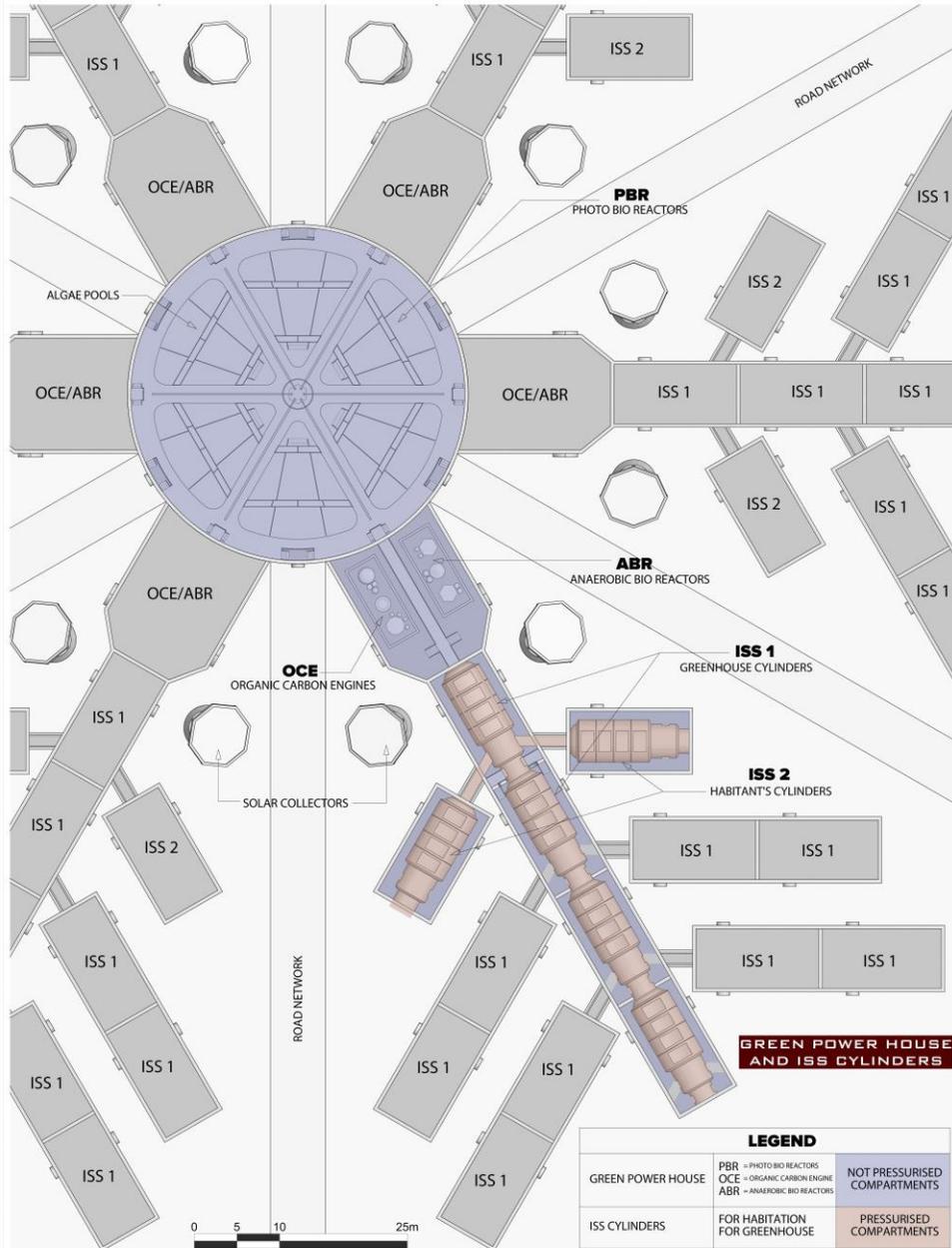
COMMUNICATION ANTENNAS

GREEN POWER HOUSE BUILDING
WITH SIX ALGAL RACEWAYS AND
BIOPROCESSORS WILL PRODUCE
BIOCHARCOAL AND ELIMINATE
WASTE.

FIRST TWO CYLINDERS OF EACH
ARM WILL HOUSE HABITANTS.

ROAD NETWORK

SOLAR COLLECTORS



LEGEND

GREEN POWER HOUSE	PBR - PHOTO BIO REACTORS	NOT PRESSURISED COMPARTMENTS
	OCE - ORGANIC CARBON ENGINE	
	ABR - ANAEROBIC BIO REACTORS	
ISS CYLINDERS	FOR HABITATION FOR GREENHOUSE	PRESSURISED COMPARTMENTS

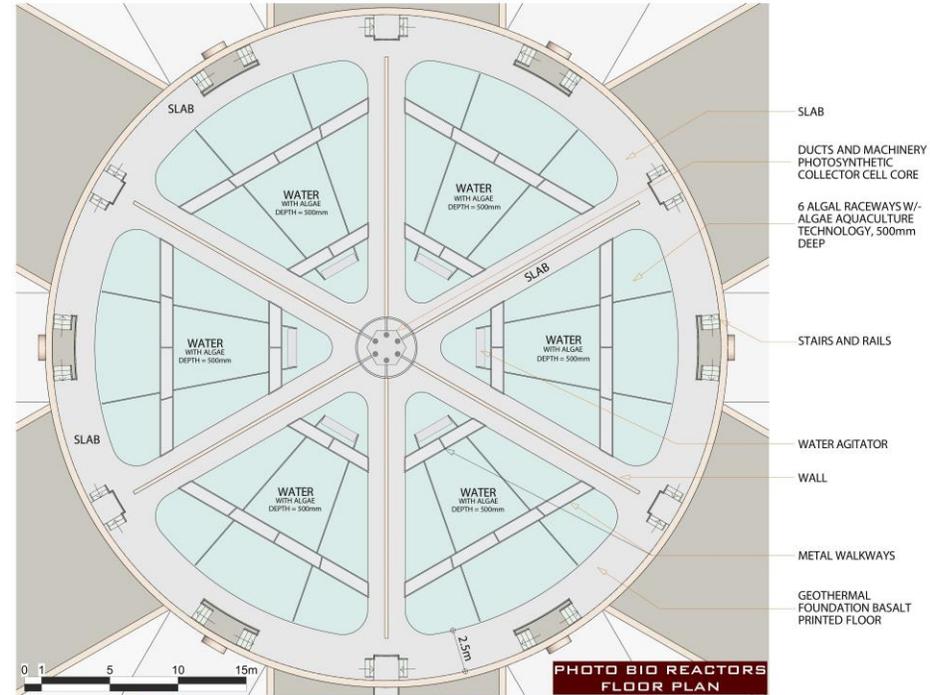
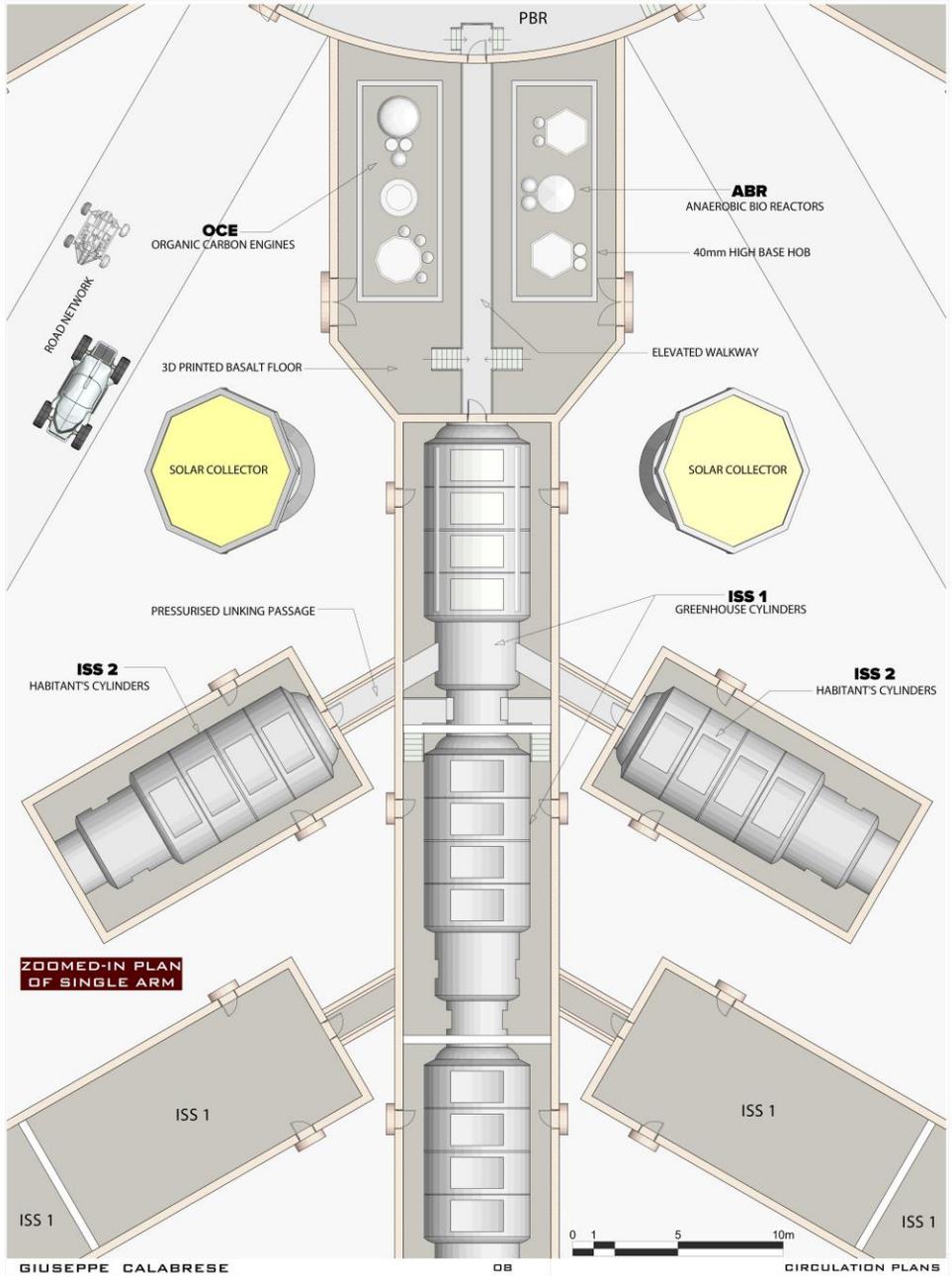
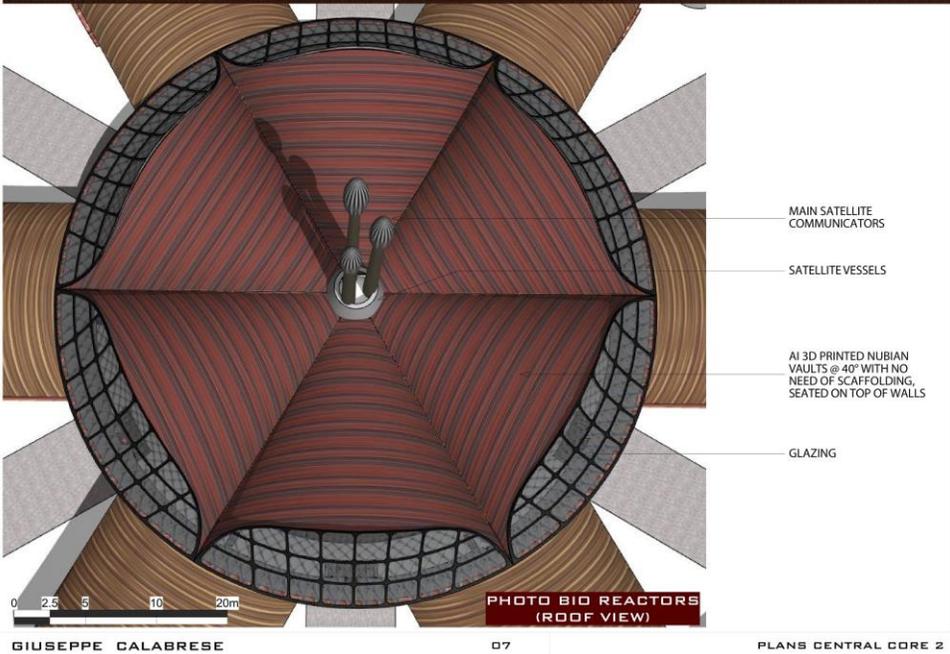
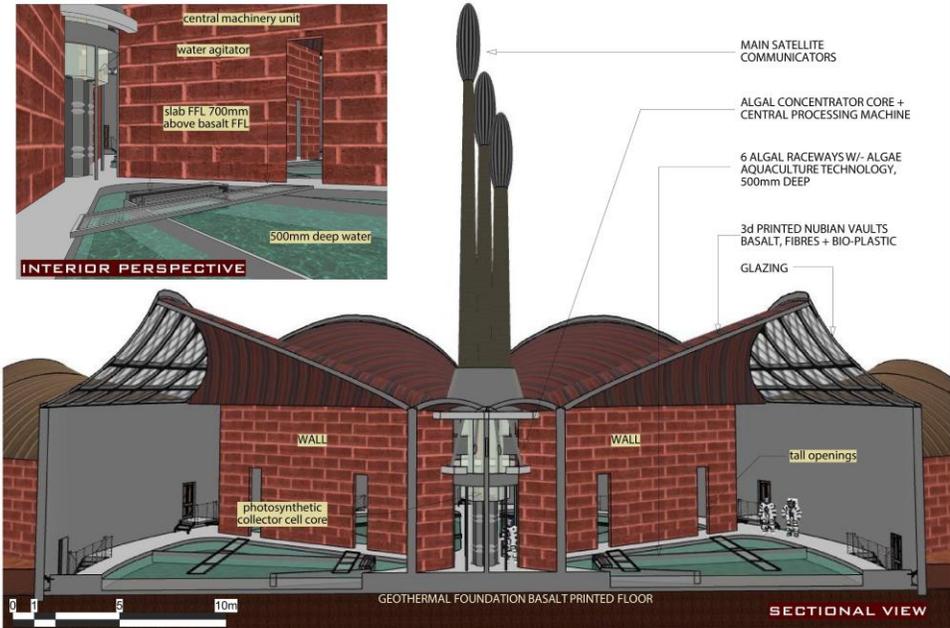
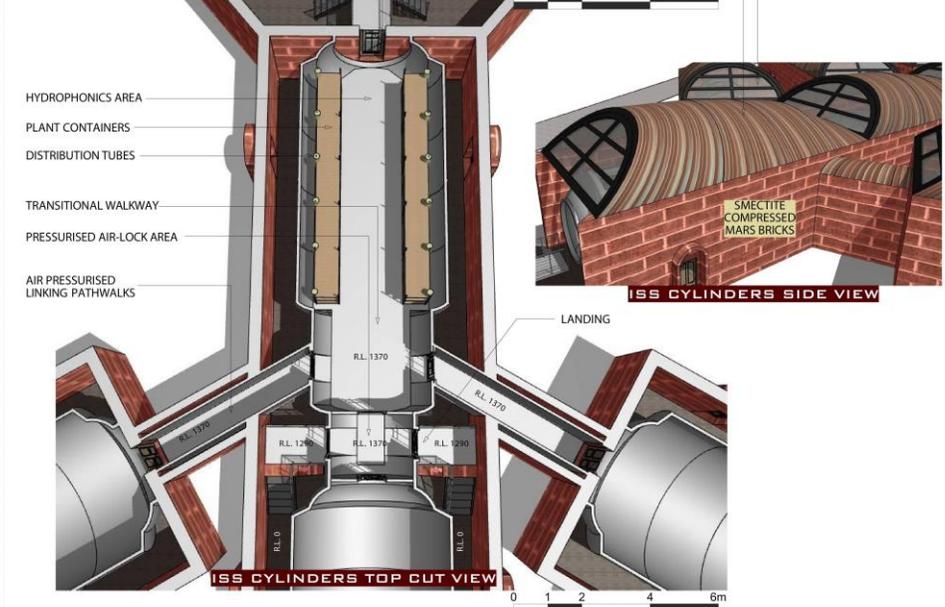
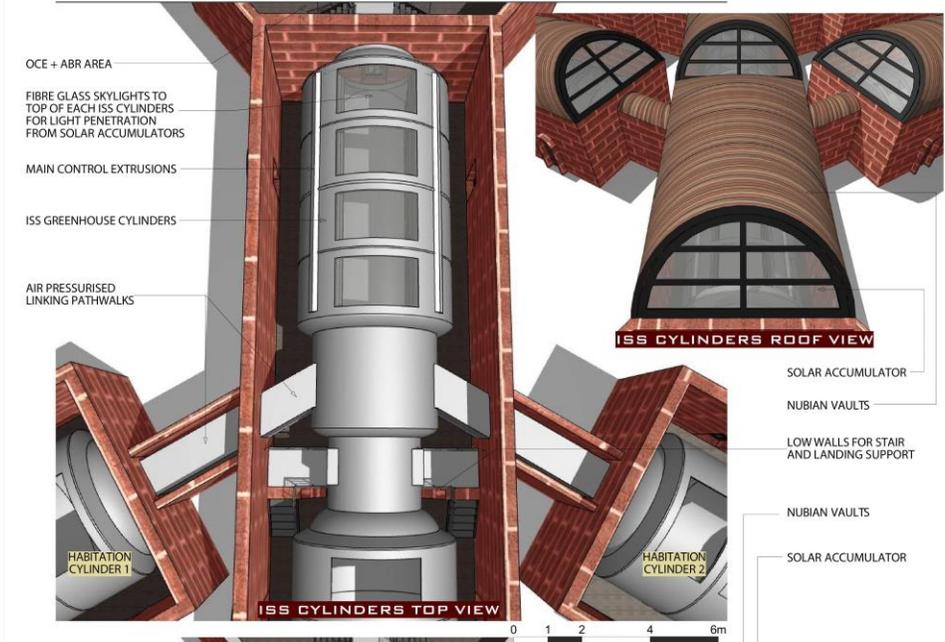
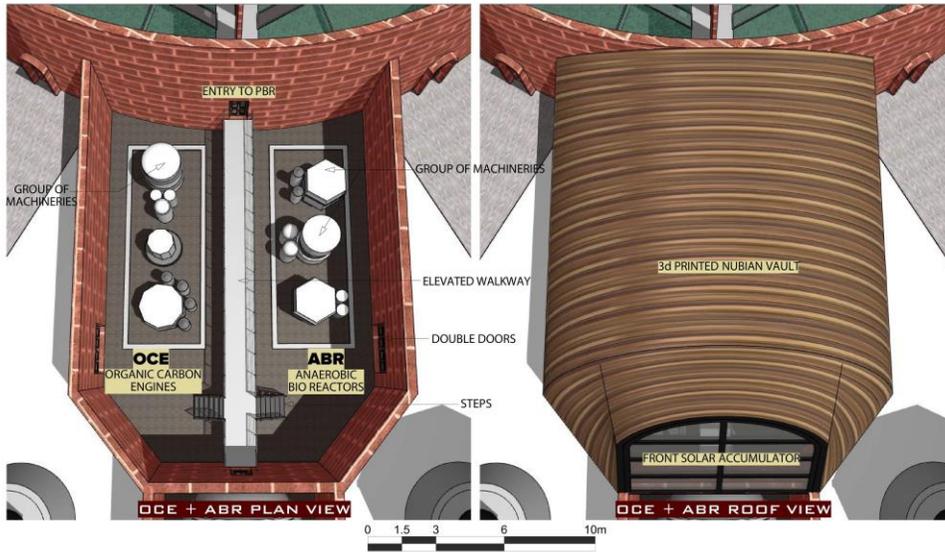


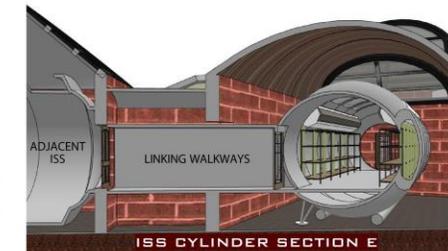
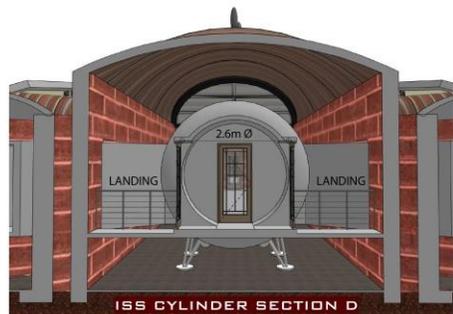
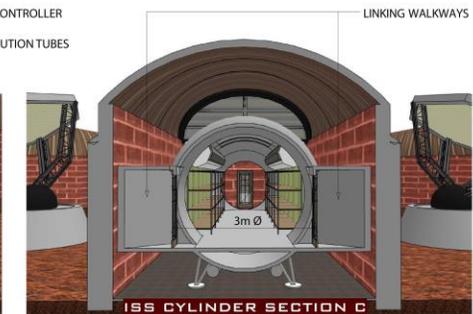
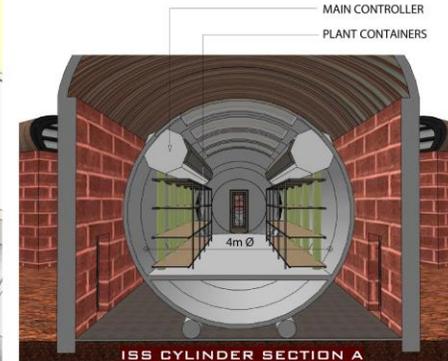
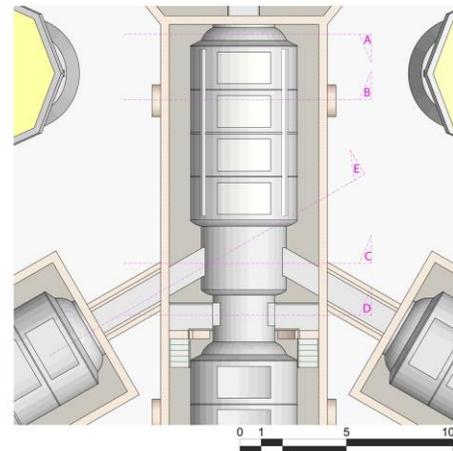
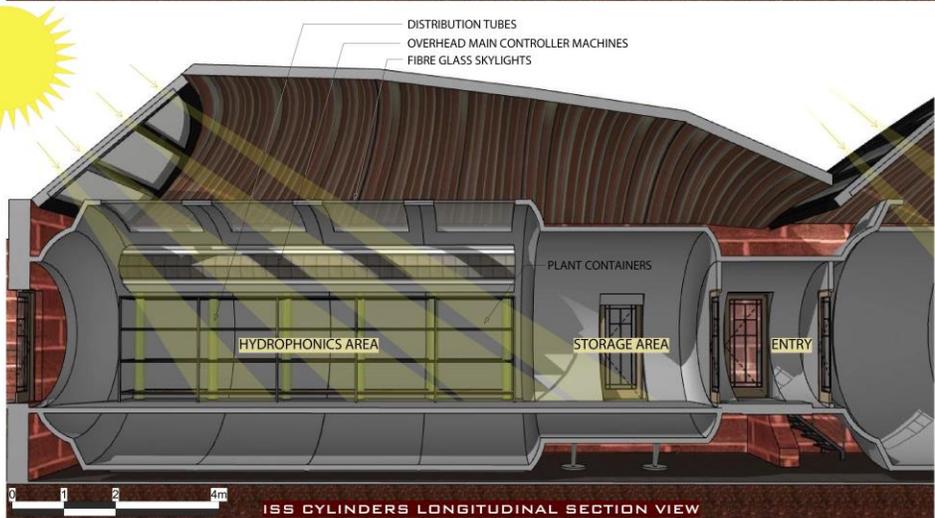
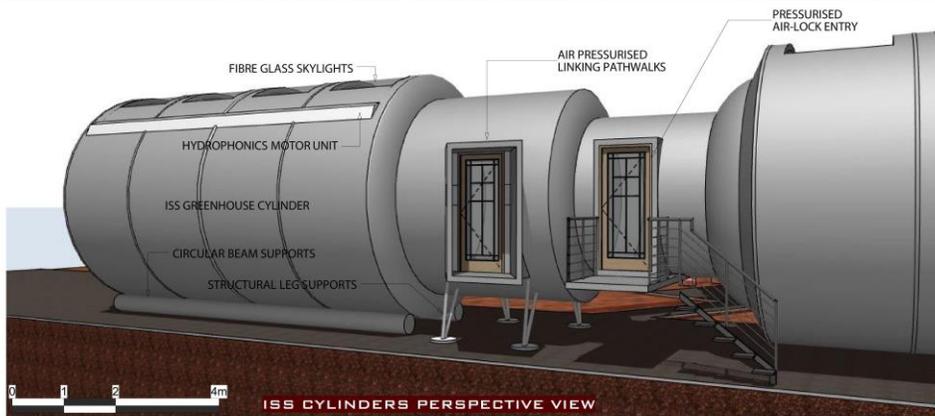
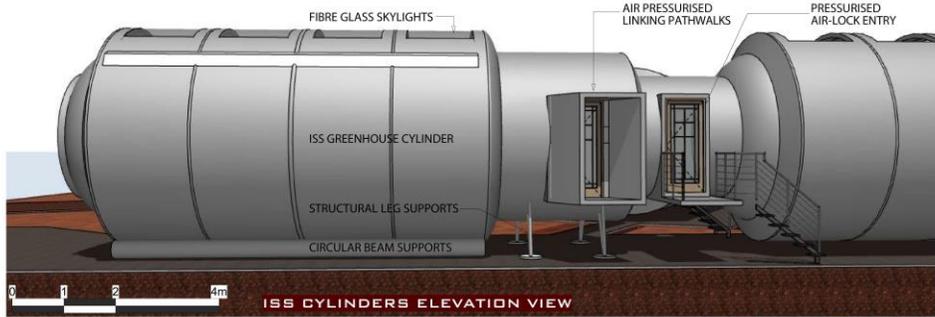
PHOTO BIO REACTORS FLOOR PLAN

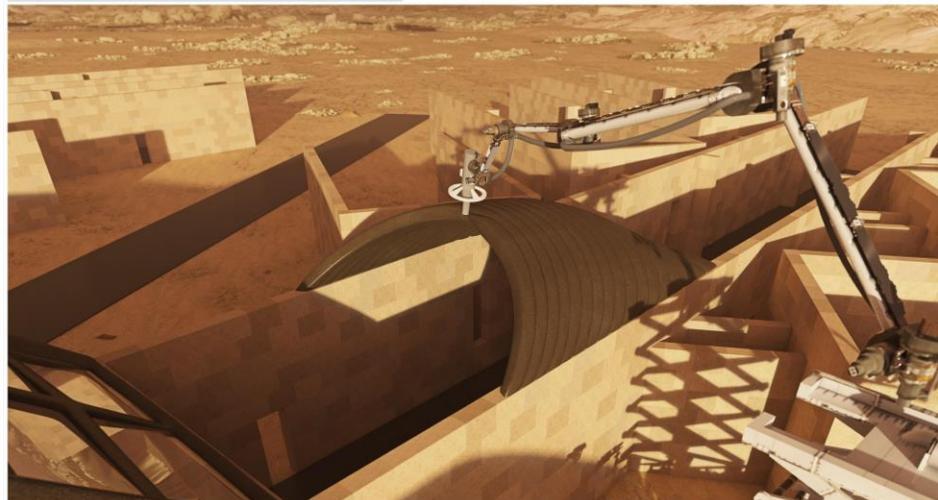
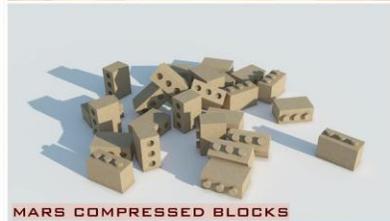
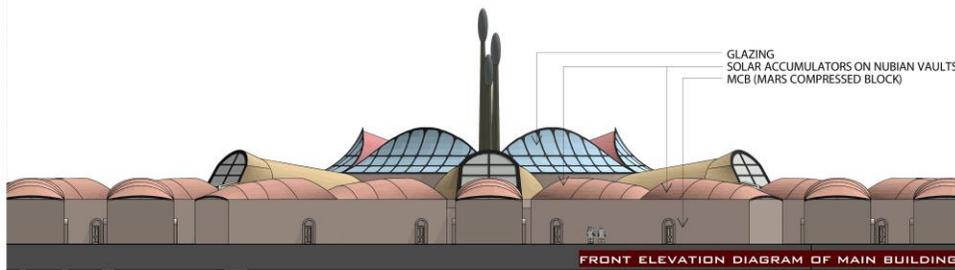
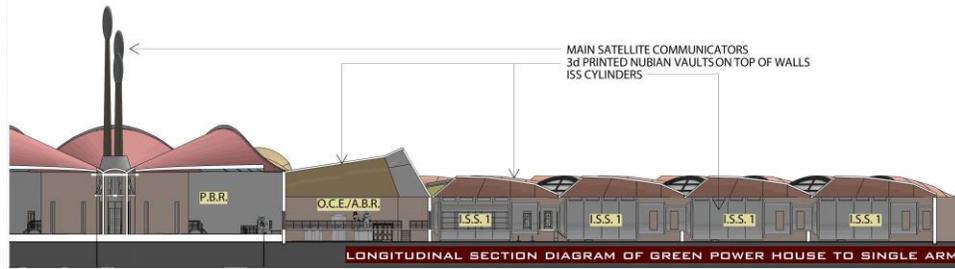
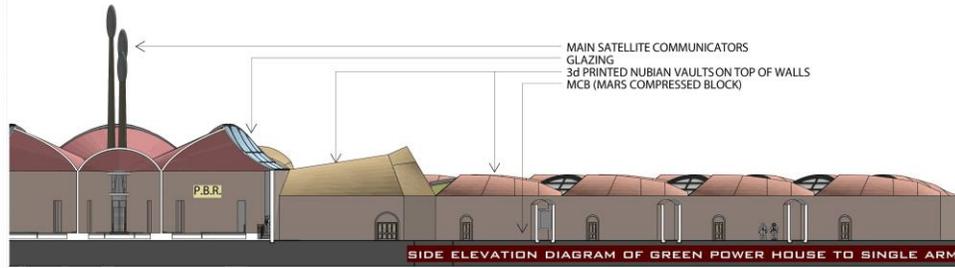


PHOTO BIO REACTORS (3D TOP VIEW)



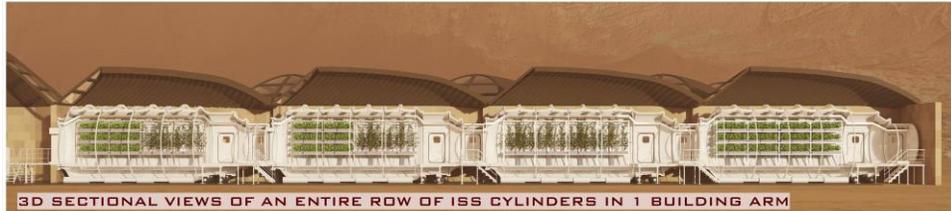








3D SECTIONAL VIEWS OF 2X LINKING ISS CYLINDERS



3D SECTIONAL VIEWS OF AN ENTIRE ROW OF ISS CYLINDERS IN 1 BUILDING ARM



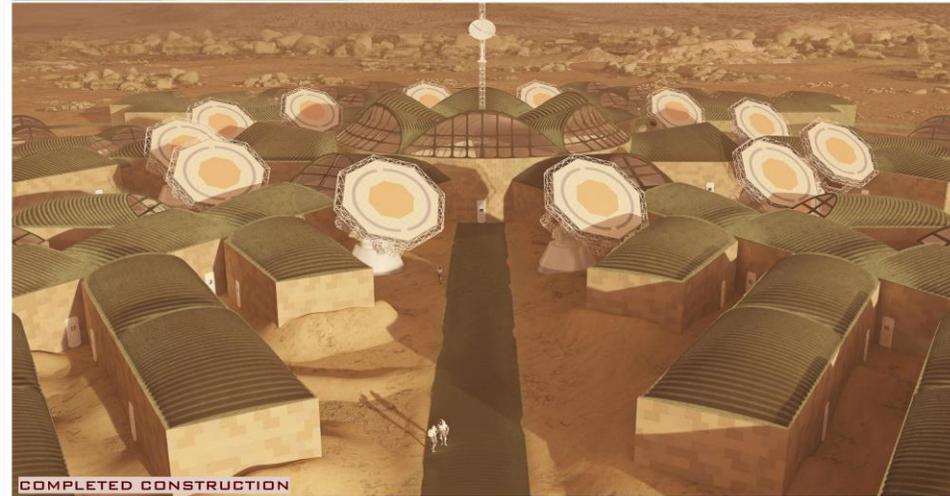
INTERIOR PERSPECTIVE OF GREENHOUSE ISS CYLINDER



PROGRESSING SHIELDING STRUCTURE CONSTRUCTION



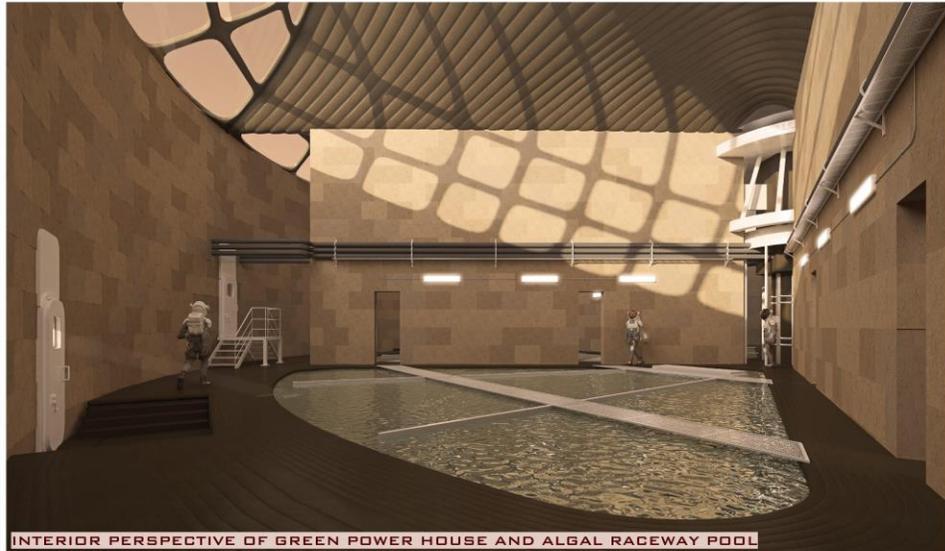
VIEW OF COMPLETED NUBIAN VAULT



COMPLETED CONSTRUCTION



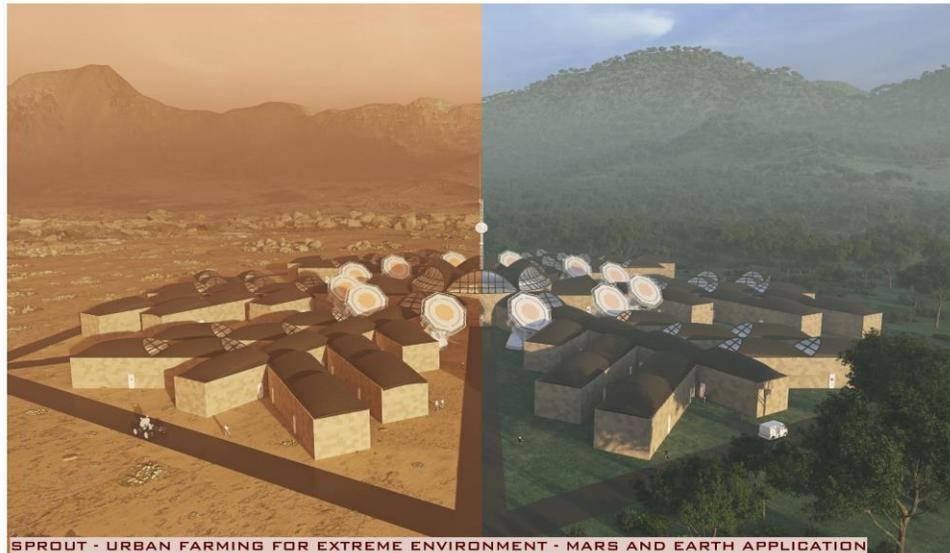
CONNECTIONS OF GREENHOUSE CYLINDERS TO THE GREEN POWER HOUSE



INTERIOR PERSPECTIVE OF GREEN POWER HOUSE AND ALGAL RACEWAY POOL



SPROUT - URBAN FARMING FOR EXTREME ENVIRONMENT - LOCATION JEZERO CRATER MARS



SPROUT - URBAN FARMING FOR EXTREME ENVIRONMENT - MARS AND EARTH APPLICATION