

Compact Living on Earth as in Space

Ever seen the Space Shuttle mid-deck? It is not very different in size, basic amenities or socio-psychological stressors to a compact home in dense cities like Mumbai, Tokyo, New York or Sao Paolo. The potential shortage of real estate, clean air, water and waste disposal in dense cities present living problems not dissimilar to those encountered in extraterrestrial, synthetic environments. The problems of odor, noise, crowding, privacy, hygiene, maintenance and storage are quite comparable.

There are some differences as well. A 25 square meter home on Earth is equivalent to a 125 cubic meter living space in Earth orbit: in the absence of gravity, the entire room from wall-to-floor-to-ceiling is available for use. In space, the other extreme difference is that you cannot easily walk out of your habitat as on Earth.

The shuttle mid-deck is a tiny space that accommodates a crew of seven, a bank of lockers, equipment bays, a toilet, a galley, an air-lock, and a ladder leading to the flight deck. (In the 1980s, it also had bunk beds that were later replaced with Velcro-able sleeping bags.) When empty, the mid-deck footprint is that of a small room measuring 4 meter in length, with a 3.7 meter rear width and a 2.7 meter front width. But with all the necessary equipment in place, you can hardly see the surface of the 2.1 meter curved walls.

Extrapolate the shuttle's habitable space a bit further and you have the International Space Station (ISS). Imagine a floating complex built with ten to twelve meter long coke-can-shaped pressurized modules connected by four-way nodes. The ISS comprises American, Russian, Japanese and European modules. Each module is outfitted differently according to the cultural, design and technical sensibilities of the sponsoring nation. Together, the modules form an integrated housing and laboratory complex.

The ISS can be compared to a Mumbai chawl.

A chawl is an integrated housing complex with four to five floors. On each floor, there are approximately ten to twenty *kohlis*, which in size and function are comparable to ISS habitat modules. Each *kohli* is essentially an all-purpose room (including living, eating and sleeping spaces) connected to a common circulating space. Chawls were built to house people migrating to Mumbai to work in the booming textile industry during the late-nineteenth century. As most of the Mumbai cotton mills have now closed or relocated, many of these chawls are being erased to make way for modern residential and commercial buildings.

Slums (informal settlements) in Mumbai are also facing severe urban redevelopment pressures. However, unlike the chawl, slum houses are compartmentally different; they are a small cube divided by two floors. The lower deck is usually the living quarter; the upper deck, which usually has a low ceiling, is a sleeping quarter and provides a little more privacy than the lower deck. A ladder connects the lower and upper decks. This two-deck arrangement is not very different than the one found on the Space Shuttle.

The chawls and slums of Mumbai occupy prime land in a city where real estate prices are among the highest in the world. With many redevelopment schemes under way to shift chawl and slum residents to new 'nanohouses' on the periphery of the city, the structural systems that supported the social-mixing of the inhabitants are under threat. With the rampant modernization of Mumbai, city politicians and builders are scheming to 'redevelop' Mumbai's slums and chawls to create business districts and residential complexes. They say they will rehabilitate the chawl and slum residents in nanohouses built in the far-flung suburbs. These so-called nanohouses being promised to the chawl and slum tenants are a sham; they are of inhuman proportions.

Mumbai is calling out for architectural interventions that address the needs of the displaced slum and chawl inhabitants. Due to the compactness of the nano and slum dwellings, perhaps the answer lies with spaceship designers.

Antidotes for Nano Homes

Designers creating comfortable living spaces for a family in a tiny apartment face problems by which approaches used by spaceship designers can be readily applied, including: designing air scrubbing systems to supply clean air in a polluted urban environment (a mix of filtration processing and recirculation), recycling grey and black water, trying to grow fresh produce locally, minimizing waste, etc. Furthermore, many considerations familiar to spaceship designers – productivity, privacy, assembly, aesthetics, identity, sensations, views, mood, safety, utilities, and adaptive use, to name just some – are increasingly relevant to the design of habitable environments in dense cities. Living both in space and in dense cities brings into sharp focus considerations such as: sustainability, material recycling, and regenerable life-support.

Although to a lesser degree than in extraterrestrial habitats, in the design of urban living spaces, one also needs to consider social and psychological stresses caused by overcrowded public spaces and utilities, cramped living and working conditions, traffic jams, pollution and a near-complete lack of privacy. Often space mission simulators are used to research the effects of long-term isolation and confinement on astronauts. These simulated environments are also useful in developing stress-busters and identifying ways to minimize conflict scenarios that can jeopardize a mission. Even in the terrestrial context, we could use environmental simulation to research the effects of long-term living in extreme urban environments – on mental performance, individual well-being, behavioral health and interpersonal relations. As on a space mission, here on Earth too, we need to develop countermeasures that can improve the quality of life.

Islands to Metropolis to Islands

The city of Mumbai is founded on an archipelago of seven islands that were, over the span of five centuries, connected through land reclamation projects to form the area of the modern city. As of the world's densest cities – with nearly 23,000 people per square kilometer – it has an estimated population of around 24 million. Just imagine the logistics and the life support systems that are required to sustain Mumbai on a daily basis. Life support comprises food and water supply, waste management systems, energy grids, air revitalization and pollution mitigation systems. In order to deal with infrastructure of this magnitude, a spaceship could serve as a rather elegant metaphor for city planners.

Imagine decomposing the city, in terms of urban planning, into modular micro-cities that function as self-sustainable islands. Each island can be designed to survive independently with a closed-loop life support system and green technologies such that the waste is minimized and whatever is generated, gets recycled back in. This will eliminate the need for long sewage networks, long-distance transportation of consumables and complicated energy grids.

These notions are outlined in the manifesto, 'The City As A Spaceship' (CAAS). CAAS will be part of a planned urban renewal with a mind to sustainability, security and quality of life. CAAS has been conceived by its founders to investigate the reciprocities between space and terrestrial architecture.

City As A Spaceship

CAAS



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Mumbai as a Spaceship Compact Living on Earth as in Space

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Technological spin-offs from space design integrate seamlessly into our daily lives but the confined conditions of extraterrestrial shuttles seldom serve as Earthly inspiration. Space entrepreneur Susmita Mohanty proffers that living conditions in outer space can inform and exchange with cramped environments down below, such as the worker-housing and informal settlements of Mumbai. And the way one thinks about space living systems can also inform the structure of urban development: the city is a spaceship.



SPACE TERMINAL MUMBAI

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