ARCH 599 Space and the City: Lessons from the Future
Instructor: Madhu Thangavelu
Units: 3
Contact Info: mthangav@usc.edu, cell/txt:(310) 561 2890
Spring 2019-Thursday – 9:00 am -11:50 am
https://pressroom.usc.edu/madhu-thangavelu/
Twitter: https://twitter.com/madhuthangavelu

1.Course Description

Space activity and space age technologies are now an integral part of, and fast becoming a positive force in city development and evolution. Space technologies are helping transform and rehabilitate old cities and their aging infrastructure too. Water and power distribution, transportation and air quality, food production, delivery and waste management, emergency health care and disaster relief all have complex interdependence through agile and advanced communications built into their vast and ever more intricate and intertwined networks. Monitoring and metering activity are all heading toward autonomy, leaving supervision and anomaly resolution as the principal tasks for human crew.

From Archeology to Agriculture and Automobile and factory emissions, space-based technologies are changing the way we see, monitor and respond to our surroundings with agility. Remote sensing allows agile monitoring of the weather and hazards like fire and earthquakes and help to organize relief efforts in ways never before possible. Technologies like high resolution hyperspectral imaging can even access yield and spot disease burden in crop and livestock and even help to contain deadly pathogens from quickly spreading into pandemics.

As the world population grows, so does the need for more resources and their efficient management. We will study, imagine and visualize how to imbibe and apply useful and appropriate technologies and processes of current and proposed human space activities to create more synergetic relationships between the manmade and natural environments using principles of human space activity as a guide.

2.Learning Objectives

Southern California has long been the nexus for aeronautical and space activity. This course is meant for the student who is curious about advances in the sciences and engineering that are being studied, pursued or implemented to make our cities, communities and dwellings more efficient and our work and leisure experiences more meaningful. This seminar will look at how our cosmopolitan cities, landscapes and dwellings are already using space assets including crew on orbiting space stations and allied technologies to monitor, inform and enhance quality of life and also predict, alert and even prevent hazards, both natural and manmade, from affecting populations adversely.

- This is a design experience seminar course that couples space technologies and human space activities with current developments in Smart City evolution and the future of human dwellings.
- Students will learn about city designs, designers & create and visualize future cities and dwellings with an interweave of space technologies aimed at improving efficiencies, including material performance and economies of energy, recycling, and maintenance as well as adaptation to climate change.
- The student's critical concept development skills to think about the future of cities and dwellings that employ Spaceflight and allied technologies
- Exposure to advanced technologies in general and human space activities in particular will enrich knowledge and enhance design and concept vocabulary in smart city and dwelling design.
- The dialog between science, engineering, art and architecture will expand student worldview.
- A team project that follows the theme of the course: Space and the City: Lessons from the Future will be the focus for creative exercise and development in this seminar.
- Students will learn how to put together materials(poster, paper) and present work for review and feedback at midterm and finals
- Produce materials for appropriate sessions in Space conferences dealing with Space Activities and the Future of Cities.
- A healthy mix of media that brings together traditional old-fashioned architecture trade skills like sketching(charcoal and pencil on flimsy) and physical model building(woodshop) and state-of-the-art digital tools like digital graphics and 3D printing of projects are encouraged.

3.Prerequisite(s): None – graduate or senior undergraduate standing

4.Co-Requisite (s): Structures and design studios or seminars are recommended

5.Concurrent Enrollment: None

6.Recommended Preparation: Curiosity about space exploration, future space activity, some familiarity with high school math and science. Several references books and online literature are recommended.

7.Course Notes

All Space and the City course notes and class transactions will be electronic. We will not use paper unless really necessary. All students will be on email roster and it is the responsibility of the student to follow notes and topic discussions using email/txt or via USC Blackboard if available.

8.Grading Type: Numeric/Letter

9.Technological Proficiency and Hardware/Software Required
If applicable, provide details of accessing course if not in a traditional classroom setting.
All required notes and class lectures will be in MS PowerPoint slides and will be distributed to entire class over email. Students should be able to access materials using email, or if available, over USC Blackboard. Graduate students and senior undergraduates who are well versed with various digital graphics packages should be able to access all materials easily and archive them as needed.

10.Lectures and Required Readings (cross referenced in syllabus schedule table)
Future of Cities – Selected Readings - https://www.gov.uk/government/collections/future-of-cities
L-1 Lecture 1 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/360814/14-814-future-cities-visual-history.pdf

L-2 Lecture 2
Three Generations of Smart Cities - https://www.fastcompany.com/3047795/the-3-generations-of-smart-cities

L-3 Lecture 3
Smart Cities: A Roadmap for Development - https://www.academia.edu/21181336/Smart_City_Roadmap

L-4 Lecture 4
The Promise of Space based Solar Power - https://www.researchgate.net/publication/280840400_The_Promise_of_Space-Based_Solar_Panels

L-5 Lecture 5
Concept Notes Indian Smart Cities
http://indiansmartcities.in/downloads/CONCEPT_NOTE_-3.12.2014__REVISED_AND_LATEST_.pdf

L-6 Lecture 6
The Internet of Space(IoS):A Future Backbone for the Internet of Things - https://iot.ieee.org/newsletter/march-2016/the-internet-of-space-ios-a-future-backbone-for-the-internet-of-things.html

L-7 Lecture 7
Responding to Climate Change NASA - https://climate.nasa.gov/solutions/adaptation-mitigation/

L-8 Lecture 8
Smart Cities of the Future - https://link.springer.com/content/pdf/10.1140%2Fepjst%2Fe2012-01703-3.pdf
Selected publications by Space Architecture community – online
http://spacearchitect.org/bibliography/

11.Supplementary Materials
AD - Space Architecture editions
AIAA Space Architecture Library – online
Alexander, C., - Notes on the Synthesis of Form
Bizony, Piers - The Making of 2001: A Space Odyssey
Bonestell, C., Space Exploration
Calder, Alexander – Works - website
Callebaut, Vincent – website
Clarke, A.C., Smith, R.A., The Exploration of the Moon
De Monchaux, N., Fashioning Apollo
Eckart, Peter - Lunar Base Handbook
Encyclopedia Astronautica - website
Fresco, Jacques - website
Fuller, Buckminster – Works – in library
Fuller, Buckminster - Operating Manual for Spaceship Earth – online
http://designsciencelab.com/resources/OperatingManual_BF.pdf
Heiken/Vaniman Lunar Sourcebook - online
Howe/Sherwood - Out Of this World
Joachim, Mitchell – website
Ley, Willy – The Exploration of Space
Lucas, George – Industrial Light and Magic - website
Mead, Syd Futurist– website
Mendell,W.W.ed.,(1985) Lunar Bases and Activities for the 21st Century – online
http://ads.harvard.edu/books/lbsa/

Miller, Ron - The Dream Machines
Muesberger/Bannova – Space Architecture Education for Engineers and Architects
NASA Human Integration Design Handbook(HIDH) – online
NASA Human Spaceflight - website
NASA International Space Station – website
NASA ISS Users Guide - website
NASA Man Systems Integration Standards, MSIS STD 3000 - website
Nixon, David – The International Space Station
Robinson, David – website
Schrunk/Thangavelu - The Moon: Resources, Future Development and Settlement
Available on Amazon : http://www.springer.com/us/book/9780387360553
SICSA University of Houston – website - http://sicsa.egr.uh.edu/
Soleri, Paolo – Works – Arcology- in library
Space Architect AIAA – spacearchitect.org
TED videos – about space projects and program – as recommended by instructor
Youtube Clips and videos - about space projects and program – as recommended by instructor

12.Description and Assessment of Assignments
A midterm and final quiz are mandatory. Student will have the choice of five options to present chosen topic for midterm and final evaluation:
1.   Write an illustrated essay with original illustrations
2.   Make a poster to mutually agreed TBD format
3.   Build a physical model
4.   Produce a digital model
5.   Create an informational video clip to mutually agreed TBD format

13.Grading Breakdown
Assignment, Quiz, Participation	30%
Midterm	20%
Finals	50%
Total	100

14.Progress Notes
        Students will be intimated throughout the semester in a timely manner about progress and what they need to do to stay on top of coursework and assigned projects.

15.Describe how, and when, assignments are to be submitted.
        Assigned readings are based on lectures and available on line. Quizzes are done in class, during seminar period. Midterm projects are due on March05, Finals on May07, in the seminar venue, before start of review. Electronic files maybe loaded on laptop and ready for viewing, posters may be pinned up and models displayed for review at start of session. It is recommended that students send files and show the models to the instructor the week before review for comments and feedback– see schedule below.

16.Additional Policies
        Late assignments – Students must make up missed assignments in quick order(before or latest by next meeting) or grade may be affected adversely.
Missed classes – please inform instructor beforehand by email.
Attendance expectations – since this is a dynamic discussion oriented seminar, continued absence will set student back such that it may be difficult to catch up.
Use of technology in the classroom – laptops and recording devices maybe used in the classroom. But any device that disrupts the lecture or class activity is not allowed.(cell phones and texting not allowed)
This course's attendance policy is consistent with the School of Architecture attendance guideline. This guideline can be found at: https://arch.usc.edu/sites/default/files/info/faculty/attendance_guideline_from_op.pdf

17.Course Schedule: A Weekly Breakdown
        Note that coursework may not follow exact flowdown listed below, but all content listed will be presented during the course of the semester. Midterm and final Quiz as well as midterm and final presentation dates are fixed : Quiz Wk 08 Midterm Wk 09-March 05, Quiz Wk 15 Finals Wk 16-May 07.

		Topics/Daily Activities	Readings and Homework	Deliverable/ Due Dates
Week 1 Date J08		Introduction to Seminar activities		
Week 2 Date J15		Space Activity Future of Cities	Future of Cities -Overview & Notes L-1	

Week 3 Date J22		CSC Aerospace Museum Visit	
Week 4 Date J29	Human Spaceflight, Biosphere, Smart City	Three Generations of Smart Cities L-2,3,5	Pick Topic Slides, Poster or Essay Due on March 05
Week 5 DateF05	Clean Renewable Space Solar Power	The Promise of Space Based Solar Power L-4	
Week 6 DateF12	International Space Station(ISS)	Notes – Human Factors	
Week 7 Date F19	Private Space Sector Ongoing and Future Missions(IoS)	The Internet of Space(IoS):A Future Backbone for the Internet of Things L-6	
Week 8 DateF26	Midterm Project	Monitor Progress	Quiz
Week 9 Date M05	Midterm Concept Presentation	Midterm Slide Presentation	Midterm Slideset, Poster or Illustrated Concept Essay *Carryover to Finals acceptable*
Week 10 Date M19	Point to Point Global Space Transportation Spaceports, Traffic	Spacex BFR and Blue Origin New Glenn - Notes	
Week 11 Date M26	Building for Climate Change	Responding to Climate Change NASA L-7	
Week 12 DateAp02	Smart Cities of the Future	Smart Cities of the Future L-8	
Week 13 DateAp09	Smart City Tour	Tour of City of Irvine	
Week 14 DateAp16	Final Assignment Monitor Progress	Monitor Progress	Poster review feedback
Week 15 DateAp23	Final Assignment Monitor Progress	Monitor Progress	Quiz
FINAL Date M07	Final Presentation	Final Project Presentation**	May 07 – 10:00am- 12:50pm

Depending on circumstances and viability due to a variety of reasons, we may tour a NASA center and/or a private

space company and a Smart City(Irvine) as opportunities allow.
**Final Project Posters to be presented at the 2019 International Space Development Conference(ISDC) and abstract submission for review at the International Astronautical Congress, Washington DC Oct 2019

18. Team Project
2019 Spring Seminar Team Project
Space Activity and the Smart City Paradigm

Abstract
    As the Smart City paradigm takes hold across new metropolises and potential human habitation zones around the globe, human space activity continues to pioneer innovation in agile, responsive building systems and their evolution, transforming habitats and surroundings to suit needs of occupants as well as adapting to both dynamic and gradual changes with minimal imposition on the natural environment that we call footprint.

    Frugal use and recycling of consumables like air and water, performant building materials, clean, renewable energy and systems that respond with agility to environmental changes are hallmarks of human spacecraft and mission management.

    The International Space Station(ISS) is a fine example of a unique, off-the-grid Earth orbiting dwelling, that has been operating for nearly 20 years in the extreme environment of space, primarily using solar power. For the past decade the ISS has also been recycling more than 90% of water used by her occupants. A crew of six continue to spend an inordinate amount of time on housekeeping functions. Ways to reduce crew time for facility maintenance, without impacting productivity or sacrificing safety have become a top priority.

    Extending our reach into space, a lunar orbiting station is being developed by NASA with another advanced layer of efficient systems to cope with this time-consuming crew deficiency. It is called system autonomy. Several parallels exist between the Smart City tenets and space system autonomy.

    Concepts are presented that depict how space activity and allied technologies are changing the cityscape; how old cities are rapidly growing and transforming aided by space technologies and how new smart cities are evolving to accommodate new needs of communities, solving age old problems and creating innovative amenities that make work and leisure more productive and enjoyable.

19. Statement on Academic Conduct and Support Systems
Academic Conduct:

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Support Systems:

Student Counseling Services (SCS) – (213) 740-7711 – 24/7 on call
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. engemannshc.usc.edu/counseling

National Suicide Prevention Lifeline – 1 (800) 273-8255
Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. www.suicidepreventionlifeline.org

Relationship and Sexual Violence Prevention Services (RSVP) – (213) 740-4900 – 24/7 on call
Free and confidential therapy services, workshops, and training for situations related to gender-based harm. engemannshc.usc.edu/rsvp

Sexual Assault Resource Center
For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: sarc.usc.edu

Office of Equity and Diversity (OED)/Title IX Compliance – (213) 740-5086
Works with faculty, staff, visitors, applicants, and students around issues of protected class. equity.usc.edu

Bias Assessment Response and Support
Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. studentaffairs.usc.edu/bias-assessment-response-support

The Office of Disability Services and Programs
Provides certification for students with disabilities and helps arrange relevant accommodations. dsp.usc.edu

Student Support and Advocacy – (213) 821-4710
Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. studentaffairs.usc.edu/ssa

Diversity at USC
Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. diversity.usc.edu

USC Emergency Information
Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible. emergency.usc.edu

USC Department of Public Safety – UPC: (213) 740-4321 – HSC: (323) 442-1000 – 24-hour emergency or to report a crime. Provides overall safety to USC community. dps.usc.edu