Robotic Construction of Lunar and Martian Infrastructures

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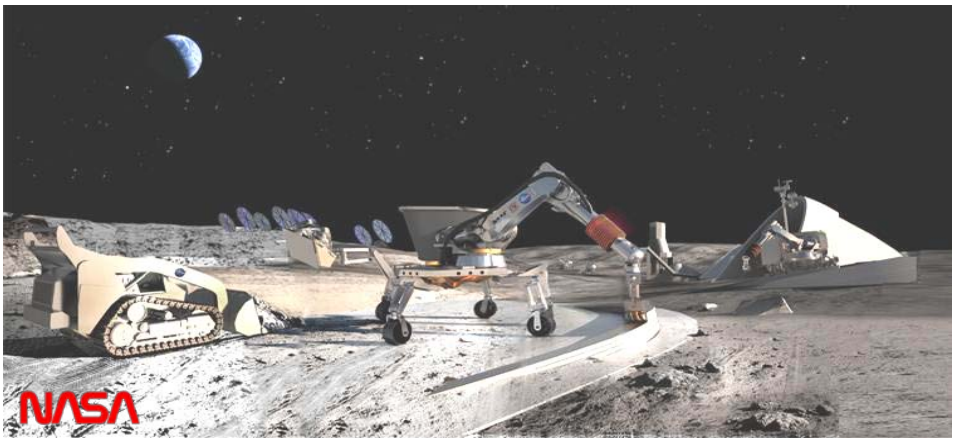

Problem: A revolution is now underway as humanity transitions from being a single planet species to a solar system species. This has been set in motion by the explosion of technologies over the 40 years since the early Moon landings of the Apollo program. Some of the key technology areas include: rocketry, robotics, additive manufacturing, chemical processing, solar power, and artificial intelligence, to name just a few. Current extraterrestrial settlement buildup philosophy holds that in order to minimize the materials needed to be flown in, at great transportation costs, strategies that maximize the use of locally available resources must be adopted but feasible construction approaches using in-situ material have been hard to conceive.

Solution: Material processing tools and construction equipment flown as cargo from Earth are proposed to build required infrastructure to support future missions and settlements on Moon and Mars. Economically viable and reliable building systems and tool sets centered around the Contour Crafting robotic construction technology are being sought, examined and tested for extraterrestrial infrastructure buildup. This NASA collaborative project focuses on a unique architecture weaving the robotic building construction technology with designs for assisting rapid buildup of initial operational capability Lunar and Martian bases.

The growing list of commercial space companies whose business plan it is to do this profitably is a good indicator that the time is now! Construction of infrastructure elements such as landing pads, blast walls, roads, hangars, radiation shields, etc. which this project addresses is the precursor to all other major planetary expeditions.

OPEN TO THE PUBLIC

Behrokh Khoshnevis is a professor of Industrial & Systems Engineering, Mechanical & Aerospace Engineering and Civil & Environmental Engineering and is the Director of the Center for Rapid Automated Fabrication Technologies (CRAFT) at USC. He is active in robotics, and mechatronics related research and development projects that include the development of three novel Additive Manufacturing (3D Printing) processes called *Contour Crafting*, *SIS* and *MPM* as well as development of mechatronics systems for biomedical applications (e.g., restorative dentistry, rehabilitation engineering, and tactile sensing devices), autonomous mobile and modular robots for fabrication and assembly applications on earth, in space and on other planets, and automated production equipment for oil (petroleum) and gas industries. He has several major inventions which have been either commercialized or are in the commercialization process. His educational activities at USC include the teaching of a graduate course on *Invention and Technology Development*. He routinely conducts lectures and seminars on the subject of invention. He is a NASA Innovative Advanced Concepts (NIAC) Fellow, a Fellow member of the Society for Computer Simulation, and a Fellow member of the Institute of Industrial Engineers. Dr. Khoshnevis' inventions have received extensive worldwide publicity in acclaimed media such as New York Times, Los Angeles Times, Business Week, Der Spiegel, New Scientist, and national and international television and radio networks. Contour Crafting was selected as one of the top 25 out of more than 4000 candidate inventions by the History Channel Modern Marvels program and the National Inventor's Hall of Fame; and has been identified as one of the major disruptive technologies of our time. See www.ContourCrafting.org

Dr. Khoshnevis received the PhD in Industrial Engineering and Management from Oklahoma State University. He was awarded the Melvin R. Lohmann Medal from the College of Engineering, Architecture and Technology at OSU.

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