Smart Cities in Space and on Earth*

Prof. Dr. Victor David Sánchez, Ph.D.
Brilliant Brains. Palo Alto, California

August, 2018

Abstract

The research and development of technologies for the design and construction of future smart cities in space and on Earth is presented. For example, space technology has allowed us over decades now to analyze the growth development of cities on Earth, cf. Figure 1 (a)-(b): Las Vegas, U.S.A., (c)-(d): Beijing, China, (e)-(f): Dubai, United Arab Emirates, over the last 30 years.

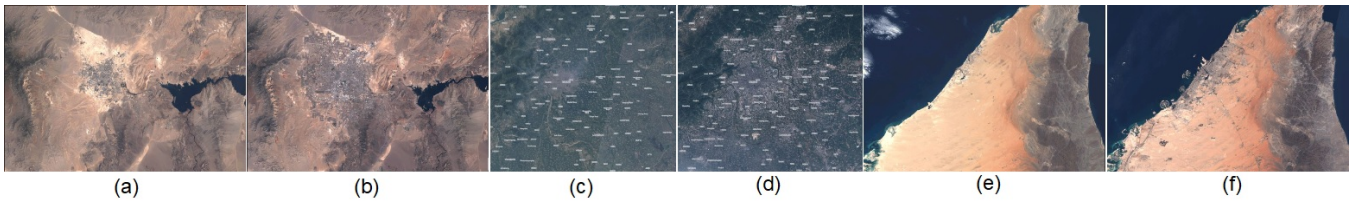

Figure 1: Growth Development of Cities on Earth [NASA-Landsat]

The author has enjoyed working over decades providing breakthroughs in literally all segments of space technology and associated terrestrial infrastructures and applications, including having helped NASA in the development of the current SLS launch vehicle family at NASA MSFC [8]. Figure 2 shows in (a) a expanded view of Block 1 of NASA's new Space Launch System (SLS), in (b) an aerial view of KSC in Florida and among others the location of the launch pad 39B (top center) reserved for the SLS, in (c) a closer view of launch pad 39B itself, and in (d) a comparison between the SLS initial lift capability (70 mT, left) with the 322-ft tall Block 1 and the SLS evolved lift capability (130 mT, right) with the 365-ft tall Block 2. The liftoff weight, cargo volume, and payload weight for Block 1 and 2 are: 5.75 and 6.5 Mlb, 9,00-22,000 ft^2 and 58,000 ft^2, 154,000 lb and 286,000 lb, respectively. The SLS is the most powerful rocket ever built, which among others will transport crewed missions back to the Moon and to Mars. The global space industry is expected to become soon a multi-trillion dollar industry [3].

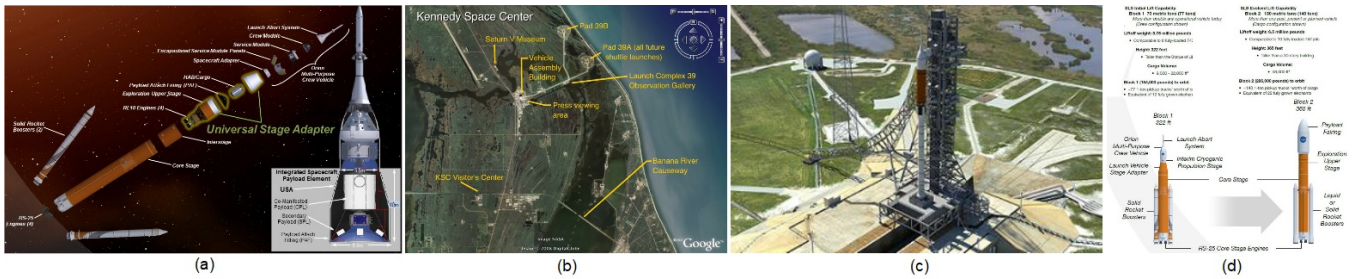

Figure 2: NASA's new SLS launch vehicle family [5] and launch pad 39B at KSC [4]

His pioneering work extends to earth orbital and deep space spacecraft and missions around the Earth and to planets [1, 2], moons, and asteroids as well as operational communications [10], navigation, and earth observation [11] satellite systems.

*This abstract has been granted permission for public release.

National laboratory centers in the U.S. and Europe he has worked at or with include the NASA Jet Propulsion Laboratory (JPL) in Pasadena, California, the NASA Marshall Space Flight Center (MSFC) in Huntsville, Alabama, ESA's European Space Research and Technology Centre (ESTEC) in Noordwijk, the Netherlands, and as civil servant of the German Federal Government for almost a decade at the German Aerospace Center DLR Institutes of Communications and Navigation, and of Robotics and Mechatronics in Oberpfaffenhofen by Munich, Germany. Companies he has worked with include Lockheed Martin, Boeing, SpaceDev, SAIC, Airbus Defense & Space, and Astrium. The author launched and led one of the world's most successful scientific journals in Artificial Intelligence in history for 15 years producing more than 50 volumes in his tenure, published by Elsevier Science, HQ in Amsterdam, The Netherlands.

An in-depth review of self-sustaining habitats to build space colonies, cf. Figure 3, is provided together with technologies that support efficient and sustainable smart cities including Artificial Intelligence (AI) [6, 12], Automation and Robotics (A&R) [7, 9] as well as transferable results towards the vehement improvement of current and future smart cities on Earth.

Figure 3: Cities in Space Colonies [NASA-ARC]

REFERENCES

[1] V.D. Sánchez et al. Mars MicroSpacecraft Bus Feasibility and Concept Design Study, Final Report, vol. I – Technical, March 1999. ACIS, JPL PO-No. 1202365, ISS No. 99-037-0.

[2] V.D. Sánchez et al. Mars MicroSpacecraft Bus Feasibility and Concept Design Study, Final Report, vol. II – Programmatic Assessment, March 1999. ACIS, JPL PO-No. 1202365, ISS No. 99-037-0.

[3] U.S. White House. That Moon Colony Will Be a Reality Sooner Than You Think, May 25, 2018.

[4] NASA KSC. Launch Pad 39B – NASA facts, 2012.

[5] NASA MSFC. Space Launch System – NASA facts, 2015.

[6] U.S. Executive Office of the President. Artificial Intelligence, Automation, and the Economy, 2016.

[7] V.D. Sánchez. Autonomous Vehicles for Space Exploration and Terrestrial Applications. `https://profdrvdsaphd.lima-city.de/documents/Autonomous.pdf`.

[8] V.D. Sánchez. Human Space Flight – From Its Beginnings to the State of the Art. `http://profdrvdsaphd.lima-city.de/documents/HumanSpaceFlight.pdf`.

[9] V.D. Sánchez. Telerobotics for Space Colonization and Industrial Applications. `https://profdrvdsaphd.lima-city.de/documents/Telerobotics.pdf`.

[10] V.D. Sánchez. Definition and Specification of a Domestic Satellite Communication System (in German), Final Report, DLR Institute of Communications and Navigation, 1985.

[11] V.D. Sánchez. A Multifunctional Earth Observation Satellite System, Final Congressional Report, Confidential, 2004.

[12] Stanford University. Artificial Intelligence and Life in 2030, One Hundred Year Study on Artificial Intelligence, Report of the 2015 Study Pane, 2016.