THE ROLE OF ECONOMIC GEOLOGY IN THE FUTURE OF SPACE RESOURCES. Brad R. Blair[1], [1]NewSpace Analytics LLC, 60 Old Schoolhouse Rd, Canterbury, NH, 03224, <planetminer@gmail.com>.

Abstract: The field of economic geology is rich with experience for the space and planetary surface frontier. The industrial development of the mineral resources of the Moon, Mars, asteroids and comets could offer unprecedented access to scientific samples for tomorrow's planetary scientist and economic geologist. Productive and balanced geoscientific partnerships exist today between academia, industry and government research. The U.S. Geological Survey (USGS) and Minerals Management Service (MMS) facilitate advanced scientific research that bring new types of mineral wealth into the U.S. economic sphere. Impartial government and university research geologists partner with the mining and energy industries to gain intimate access to 3D information (mineral samples and geologic context) at minesites and boreholes across the U.S.A. and its terretorial waters. Experience from these successful public-private partnerships can inform future NASA science missions by making advanced methods and tools available that have worked well in the past. These include lessons learned for science valuation methods and can inform and calibrate program-level and architectural tradeoffs with real-world data.

Analogies will be offered that could illuminate a future leadership path for NASA that is based on historical USGS and industrial partnership experience. Commercial development of lunar resources offers advanced off-budget access to the space researcher that leverages private funding to dramatically increase scientific return. Indeed, a feasible path to the economic development of space mineral resources has been illuminated by decades of NASA-led scientific exploration, starting with the stellar Apollo human missions and precursor robotic programs.

To provide a context for discussing future roles for NASA, academia and private industry, conceptual scenarios will be offered as quad charts that visualize future mining and resource utilization on planetary surfaces, interiors, atmospheres, etc. This will be balanced by a year 2050 space infrastructure and customer forecast that includes orbiting shipyards, refueling nodes, tourism and colonization. Metrics will be offered in order to estimate commercial progress toward critical milestones in order to can calibrate schedules and adjust expectations. There will be a specific focus on the type and quantity of geologic data that will be associated with a planetary minesite based on mining industry practices and standards.

References:

[1] Arthur Dula (Editor), and Zhang Zhenjun (Editor), *Space Mineral Resources: A Global Assessment of the Challenges and Opportunities*, IAA Cosmic Study 3.17, Virginia Edition Publishing Company, 27 November 2015, 472 pages, http://www.amazon.com.au/Space-Mineral-Resources-Assessment-Opportunities-ebook/dp/B018OJD95Q

[2] Baiden, G., Grenier, L. and Blair, B., "Lunar Underground Mining and Construction: A Terrestrial Vision enabling Space Exploration and Commerce," 48th AIAA Aerospace Sciences Meeting, Including the New Horizons Forum, 4-7 January 2010, Orlando, FL, http://enu.kz/repository/2010/AIAA-2010-1548.pdf

[3] Blair, B., Diaz, J., Duke, M., Lamassoure, E., Easter, R., Oderman, M., and Vaucher, M., *Space Resource Economic Analysis Toolkit: The Case for Commercial Lunar Ice Mining*, Final Report to the NASA Exploration Team, December 20, 2002, 71p., http://www.nss.org/settlement/moon/library/2002-CaseForCommercialLunarIceMining.pdf

[3] Blair, B., "An Economic Paradigm for Commercial Lunar Mineral Exploration," 2nd Lunar Development Symposium, Las Vegas, NV, Proceedings printed by Space Studies Institute, Princeton, NJ, 2000, 11p., http://ssi.org/ssi-conference-abstracts/return-to-the-moon-ii-2000/