APPLICATION AND CONSIDERATIONS FOR NANOSCALE VIBRATION REMOTE SENSING TECHNOLOGY FOR DETECTION OF MICROORGANISMS IN THE MARTIAN POLAR REGIONS. P. A. Johnson[1,2], J. C. Johnson[1,2] and A. A. Mardon[2], [1]University of Alberta (email: paj1@ualberta.ca) [2]Antarctic Institute of Canada (103, 11919-82 Str. NW, Edmonton, Alberta CANADA T5B 2W4; email: aamardon@yahoo.ca)

Introduction: The possibility of life on Mars is a largely explored field of space research. A promising area of interest are the polar ice caps along with regions characterized by surface frost and water ice glaciers, particularly because the presence of water in itself, is known to be key to life, although there are several hypotheses suggesting the feasibility of extraterrestrial extant life with a source of energy and stable environmental conditions alone. We hereby describe a novel remote-sensing probe and design considerations for its use in Martian topography and climate conditions.

Remote sensing probe: Traditionally, remote-sensing techniques rely primarily on elemental composition analyses for identification of biomarkers that can discriminate the presence of microorganisms. One concern is that the use of Earth's signature of life criteria for Mars is limited. We have previously described the use of soil sampling with nano-scale vibration sensors for remote sensing and on-site detection of microorganisms [1]. This technology utilizes nano-vibrations created by the metabolic activities of microorganisms to detect the presence of life. It additionally allows for the combination of dynamic and chemical information to identify and characterize life. Moreover, its application extends from regolith and rocks to ice and permafrost, which means it has the potential to identify life in close proximities and within the polar regions of Mars.

Design considerations: With the geographical distinctions characterizing the polar ice caps and glaciers however, it is essential for us to make several modifications to the existing technology. First and foremost, the technology should be resistant to malfunction in colder temperatures. This can be achieved through the use of thermally protective material in design. Reinforced carbon-carbon, LI-900 silica ceramic coating, and insulation tiles are examples of materials which can be utilized for this thermal protection. Our group has also previously examined design considerations for motor units of space probes and unmanned aerial vehicles for use in Mars missions [2]. We would like to extend these considerations for remote-sensing probes as well. These considerations include: (i) power considerations, (ii) high climb and loiter speed, (iii) data-link bandwidth capabilities. (iv) navigation, (v) rotor use in Mars' gravitational field, and (vi) emergency considerations including loss of contact with ground control.

References: [1] Johnson J.C. *et al.* (2019) Soil sampling with nanoscale vibration sensors for on-site detection of microorganisms. *Mars Extant Life: What's Next?*. Abstract #5079 [2] Johnson J.C. *et al*. (2019) Design considerations to tailor unmanned aerial vehicles for martian geoclimatic condition. *American Research Journal of Humanities and Social Sciences*, 5(1), 1-2.