**LARA: Biologically inspired Engineering and Exploration System Mission concept and components for lunar exploration and exploitation tools.** P.E. Clark1 (Contact Author), S..A. Curtis2, C.Y. Cheung2; M.L. Rilee1, G. Marr2; W. Truszkowski2, Contact address: Pamela Clark, Code 695, NASA/GSFC, Greenbelt, MD 20771, 301-286-7457, Pamela.clark@gsfc.nasa.gov; 1Affiliation: L3 Communications, Government Services, Inc., 3750 Centerview Drive, Chantilly, VA 20151, 2Affiliation: Code 695, NASA/GSFC, Greenbelt, MD 20771.

ANTS (Autonomous Nano Technology Swarm) Architecture is well suited to surface-based forms for use on the Moon or Mars or any relatively low G surface environment, as illustrated by an application called LARA (Lander-Antenna-Rover Arrays). ]. Here, we analyze the nature of components and sequence of behaviors required for spacecraft operational scenarios for an ANTS application in a low gravity surface.

**Introduction**: Basic structural components would , as in other applications, be highly modular, addressable arrays of more robust than Zero G carbon NEMS-based nodes, from which highly morphable struts, tethers, 2D mesh, and 3D fabric could be reversibly deployed for various functions. Individual craft would be released, possibly by a human crew on or near the Moon or from an unmanned facility. Individual craft would be capable of landing on a low G surface, using a miniaturized version of high impulse thruster technology, transforming into rovers, antennas, or more specialized service providers, as needed, and ultimately taking off to return to the point of release.

**Methodology**: We have developed preliminary conceptual and physical models of spacecraft and components and models of the interaction of ANTS at the spacecraft level in order to determine hardware and software requirements for typical operations driven by operating on a loECONOMIC PRICE ADJUSTMENTSTANDARD SUPPLIES (52.2162) (JAN 1997)(a) The Contractor warrants that the unit price stated in the Schedule for [offeror insert Schedule line item number] is not in excess of the Contractor's applicable established price in effect on the contract date for like quantities of the same item. The term "unit price" excludes any part of the price directly resulting from requirements for preservation, packaging, or packing beyond standard commercial practice. The term "established price" means a price that (1) is an established catalog or market price for a commercial item sold in substantial quantities to the general public, and (2) is the net price after applying any standard trade discounts offered by the Contractor.(b) The Contractor shall promptly notify the Contracting Officer of the amount and effective date of each decrease in any applicable established price. Each corresponding contract unit price shall be decreased by the same percentage that the established price is decreased. The decrease shall apply to those items delivered on and after the effective date of the decrease in the Contractor's established price, and this contract shall be modified accordingly.(c) If the Contractor's applicable established price is increased after the contract date, the corresponding contract unit price shall be increased, upon the Contractor's written request to the Contracting Officer, by the same percentage that the established price is increased, and the contract shall be modified accordingly, subject to the following limitations:(1) The aggregate of the increases in any contract unit price under this clause shall not exceed 10 percent of the original contract unit price.(2) The increased contract unit price shall be effective (i) on the effective date of the increase in the applicable established price if the Contracting Officer receives the Contractor's written request within 10 days thereafter or (ii) if the written request is received later, on the date the Contracting Officer receives the request.(3) The increased contract unit price shall not apply to quantities scheduled under the contract for delivery before the effective date of the increased contract unit price, unless failure to deliver before that date results from causes beyond the control and without the fault or negligence of the Contractor, within the meaning of the Default clause.(4) No modification increasing a contract unit price shall be executed under this paragraph (c) until the Contracting Officer verifies the increase in the applicable established price.(5) Within 30 days after receipt of the Contractor's written request, the Contracting Officer may cancel, without liability to either party, any undelivered portion of the contract items affected by the requested increase.(d) During the time allowed for the cancellation provided for in subparagraph (c)(5) above, and thereafter if there is no cancellation, the Contractor shall continue deliveries according to the contract delivery schedule, and the Government shall pay for such deliveries at the contract unit price, increased to the extent provided by paragraph (c) above.(End of clause)w gravity surface to support a human crew.

**Discussion**: As in the other applications of the ANTS architecture, movement would not employ wheels, which work best in a special environment. Instead, the ANTS approach harnesses the effective skeletal/ muscular system of the frame itself to enable more ‘natural’ movement, effectively allowing ‘flow’ across a surface or into a particular morphological form. As rovers, craft would be equipped for exploring, prospecting, monitoring, as required. Craft could individually or collectively form cylindrical or bowl shaped arrays to act as antennas, for communication or astronomical observatories. The architecture would also be useful in the construction of tools and structures for human occupation of permanent bases. ANTS structures, operating continuously or on demand, could be thus used for exploration, reconnaissance, communication, navigation, transportation, construction, permanent monitoring, or observation, protecting human crews and facilitating their work.

**Conclusions:**  The ANTS architecture is a promising approach for supporting human crew activities on the surface of the Moon or Mars as part of the new NASA iniative.

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