

Abstract Submission to the 4th IAA International Conference on Low Cost Planetary Missions to be held May 2 - 5, 2000 at The Johns Hopkins University Applied Physics Laboratory, Laurel, Maryland USA

BIOMORPHIC EXPLORERS & BIOMORPHIC MISSIONS

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The concept of "Biomorphic Explorers" represents small, dedicated, low-cost explorers that possess some of the key features of biological systems, not easily captured by conventional robotic exploration systems. Such features include versatile mobility, adaptive controls, bioinspired sensor mechanisms/sensor fusion, biomorphic communications, cooperative behavior, distributed operations, and biomorphic energy generation/conversion. Significant scientific payoff at a low cost is realizable by using the potential of a large number of such cooperatively operating biomorphic explorer units. A classification of these explorers by size/mass/functionality, with example candidates in each category will be presented. The biomorphic flight systems are extremely attractive for solar system exploration because of their potential large range, unique imaging perspective, and the access to here-to fore inaccessible sites that they would provide. A variety of cooperative mission scenarios will be presented, which suggest the applicability of biomorphic explorers to multiple applications. Specific science objectives targeted for these missions include atmospheric information gathering by distributed multiple site measurements, close-up imaging for geological site selection, deployment of surface payloads such as instruments/biomorphic surface or subsurface systems/surface experiments and sample return reconnaissance. Candidate examples of both atmospheric and imaging payloads along with imaging strategies to obtain stereo images with high spatial resolution will be discussed. Spatial resolution of ~ 0.5 cm/pixel is achievable with pictures taken in flight at an altitude of 50 m. Communication between the biomorphic flyers (individually or as multihub clusters), the local relay (probe shell, relay javelin, lander, tethered balloon), and the orbiter is crucial to attaining the science objective. A technology roadmap for realization of biomorphic flyers in the near term and biomorphic explorers in the long term will be presented. Specifically, the mission concept of surface launched microflyers for reconnaissance missions will be described in detail because of its near term applicability as an auxiliary payload within the 2003/2005 Sample Return Mission to Mars.

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