The Field Robotics Center

Seminar Series

Fri, July 26 **NSH 1305** **2:00-3:00PM**

Food and Drinks will be served

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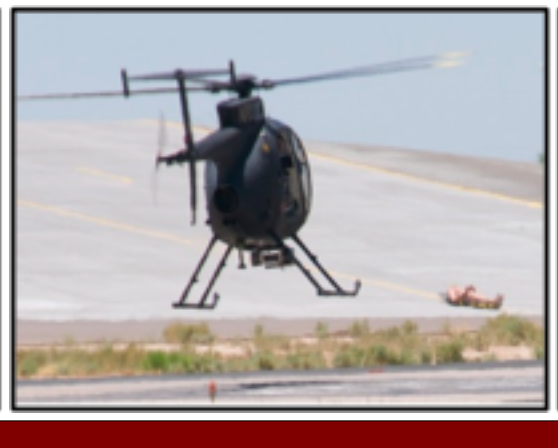
NASA

ATHLETE - A Space Robot for Large Payloads

Abstract: As part of the Human-Robot Systems project funded by NASA, the Jet Propulsion Laboratory (JPL) has developed a vehicle called ATHLETE: the All-Terrain Hex-Limbed Extra-Terrestrial Explorer. Each vehicle is based on six wheels at the ends of six multi-degree-of-freedom limbs. Because each limb has enough degrees of freedom for use as a general-purpose leg, the wheels can be locked and used as feet to walk out of excessively soft or other extreme terrain. Since the vehicle has this alternative mode of traversing through or at least out of extreme terrain, the wheels and wheel actuators can be sized for nominal terrain. There are substantial mass savings in the wheel and wheel actuators associated with designing for nominal instead of extreme terrain. These mass savings are comparable-to or larger-than the extra mass associated with the articulated limbs. As a result, the entire mobility system, including wheels and limbs, can be substantially lighter than a conventional mobility chassis. A side benefit of this approach is that each limb has sufficient degrees-of-freedom to use as a general-purpose manipulator (hence the name “limb” instead of “leg”). Our prototype ATHLETE vehicles have quick-disconnect tool adapters on the limbs that allow tools to be drawn out of a "tool belt" and maneuvered by the limb. A power-take-off from the wheel actuates the tools, so that they can take advantage of the 1+ horsepower motor in each wheel to enable drilling, gripping or other power-tool functions.
We describe a scaling analysis of ATHLETE for exploration of the moon, Mars and Near-Earth Asteroids (NEAs) in comparison to a more conventional vehicle configuration. Recently, the focus of human exploration beyond LEO has been on NEAs. A low gravity testbed has been constructed in the ATHLETE lab, with six computer-controlled winches able to lift ATHLETE and payloads so as to simulate the motion of the system in the vicinity of a NEA or to simulate ATHLETE on extreme terrain in lunar or Mars gravity. Test results from this system are described.

Speaker Bio: Brian Wilcox is the manager of Space Robotics Technology in the Solar System Exploration Directorate and is the Principal Investigator for ATHLETE – the All-Terrain, Hex-Limbed, Extra-Terrestrial Explorer. He was the supervisor of the JPL Robotic Vehicles Group for over 20 years, during which the group was responsible for planetary rover development leading up to the Sojourner and Mars Exploration Rovers. The group was responsible for development of the electronics, control, flight software, ground software, and mission operations of the Sojourner rover that explored part of Mars in 1997. Brianwas personally responsible for the imaging and hazard detection sensors and the hazard avoidance algorithms on Sojourner. He has a B.S. in Physics and a B.A. in Mathematics from the University of California at Santa Barbara, and an M.S. in Electrical Engineering from the University of Southern California.



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