

Human Augmentation System For Heavy Maintenance



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Problem

- Many jobs require workers to operate heavy tools that put them at risk
- Current practices attempt to minimize but don't solve the problem
 - Make tools lighter
 - Minimize tool vibrations
 - Processes and tools limited by human strength and endurance
- Impacts to Total Ownership Cost / Productivity / Injury Rates
 - Life Cycle Costs
 - Productivity
 - Quality
 - Manpower
 - Personnel/Training
 - Safety/Worker's Comp



Technology Description

- **Human Augmentation System (HAS)**

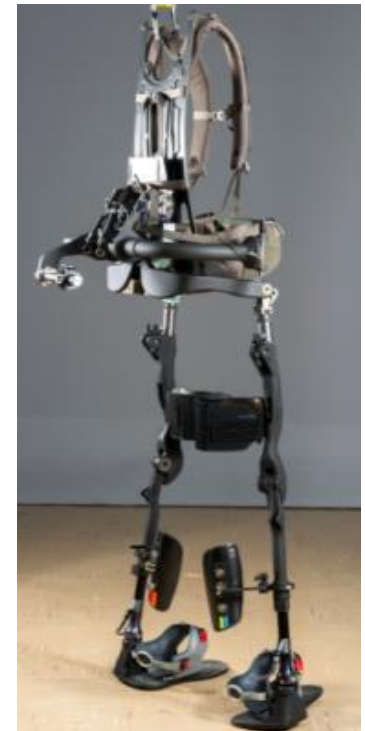
- Increases productivity & quality of work, with reduced injury

- **zeroG[®] - Exoskeletal Arm Systems:**

- Allows operators to use heavy tools as if weightless
- Supports the tool through a wide range of motion
- Requires no power
- Can reduce vibration transmission to operator
- Single arm stabilize tools up to 40 lbs

- **MANTIS[™] - Lower Body Exoskeleton**

- Provides critical mobility platform
- Transfers loads through structure to the ground
- Anthropomorphic design maintains operator flexibility
- No power, electronics, actuation required
- Simple to operate and minimal training required



Technology Status

- **Maturity:**
 - MANTIS Exoskeleton: TRL 6, MRL 6 (prototype systems available and demonstrated)
 - zeroG Arm: TRL 9, MRL 9 (production systems available and demonstrated)
- **Initial Heavy Tool Application Targets:**
 - Grinding
 - Sawzalls
 - Heat Induction tools
 - Blasting / Hydrolancing
 - Needle Guns
 - Impact Wrenches
 - Torque Wrenches
 - Painting
- **Possible Obstacles**
 - Qualification and certification across DoD applications
 - Tailoring the system to meet all applications and environments
 - Business Case needs to be proven for each application and facility
- **Likely Outcome: Significant productivity improvements & injury reductions**
- **Competition: There are no available competing systems, however others are trying to develop and mature competing solutions**

Vision

- **Wide applicability across DoD Maintenance, Construction & Support Communities**
 - Integration with current DoD processes and tools with minimal or no modifications
 - Modular HAS can be deployed with different attachments tailored for specific applications
- **IP/Data Rights Established**
 - IP package includes multiple patents, trademarks, and copyrights
 - Lockheed Martin and Equipois maintain ownership/rights to their respective IP
- **Initiating Qualification / Certification Process**
 - Actively engaged in creating database to establish benefits and business case
 - Need to determine common set of certification requirements
- **Evaluating near term funding requirements, securing sponsorship within the Navy**
 - Need to establish awareness and sponsorship across DoD
 - Multi-service funding will accelerate adoption of this technology
- **Future Steps**
 - Optimization of MANTIS design for production
 - Integration across the DoD Maintenance applications
 - Army and Navy developing HAS technology for Pick & Place/Material Movement (Based on Army sponsored HULC system)

Questions?