



Application Success Note

Application:

Large Payload
Robotic Delivery
Vehicle

Product:

S-Series SMART
Hydraulic Actuators

Industries:

Military/Defense

Robotic Delivery Vehicle with >2,000Lb Capacity



Challenge:

Kyntronics customer [RMD Systems](#), was tasked with designing a large legged robotic platform, referred to as Autonomous Field Supply Vehicle (AFSV) for transporting sensitive payload on a military application.

The payload was over 2,000 lbs, and extremely sensitive to shock and vibration. RMD needed an actuator that was capable of providing high force in a small package. Additionally, the actuator needed to be rugged enough for outdoor use, power efficient, and tolerate high shock loading.

Solution:

RMD tested hydraulic actuators, electromechanical actuators (EMAs), and electro-hydraulic actuators during the design phase. A purely hydraulic solution was deemed too heavy and complex with the required hoses, tubing, and valves, while electromechanical actuators did not have the force density or the durability against shock loading required for the application.

The electro-hydraulic actuators from Kyntronics provided the force density and durability of a hydraulic solution, while also providing the low mass and ease of system integration characteristics of an EMA solution. Additionally, the valving inside the Kyntronics actuator allowed the actuators to hold a static load without consuming any power.

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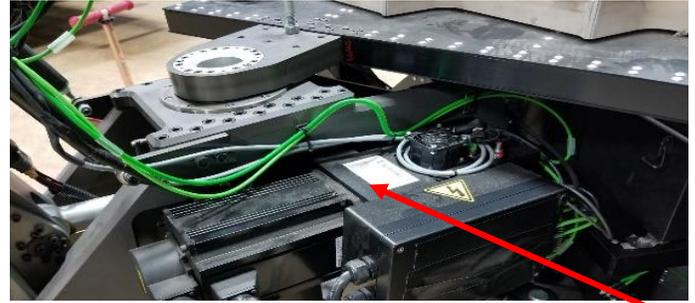


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To find out how the advantages of Kyntronics SMART Hydraulic Actuators can improve your company's machines and processes, [contact our Engineering team.](#)



Coxa actuator installed on the vehicle. This actuator is responsible for rotating the leg around its vertical axis (analogous to the hipjoint). A linkage was used in order to transform the 6" stroke of the actuator into 180 degrees of rotation



The femur actuator installed on the leg. The femur actuator was installed on its side to reduce the overall thickness of the vehicle. By installing the femur inside the coxa structure, RMD was able to reduce the inertia of the leg, improving the walking performance

Results:

RMD successfully designed, built, and tested the AFSV in 20 months from project kickoff. Kyntronics provided three configurations of actuators based on the force and speed requirements of the specific leg joints (Coxa, Femur, and Tibia joints). The actuators were integrated with RMD's gait engine control software that utilizes position and force feedback from the actuators to control the legs and the body of the vehicle. The system has demonstrated omnidirectional walking, six DOF body control, and operation on various terrain types while carrying a simulated payload.



The tibia actuator is the last active joint in the leg. The tarsus joint (which is attached to the foot) is driven by a bellcrank mechanism that keeps the foot perpendicular to the ground without requiring active control. The position sensor can be seen on the side of the actuator. This sensor provides position feedback on the rod position of the actuator, which is used to calculate the overall pose of the leg



Kyntronics SMART electro-hydraulic actuators (SHA) shown in the three configurations used on each leg of the AFSV

Watch a [video of the AFSV](#) in operation. The Kyntronics all-in-one SHA combines the power of hydraulics with the precision of servo control resulting in an innovative solution for this application.

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