Hazardous Situations Require a Dependable Brake

Safety is an important factor when deciding on the best brake for your application.

BY MICHAEL VASKO, OGURA

Today, we live in a dangerous world. Terrorism is real and a part of our everyday lives both abroad and in our own back yards. We hear and see reports almost on a daily basis, yet there are probably dozens of other thwarted terrorism attempts of which we will never have an inkling of having occurred. Among the hundreds of entities devoted to avoiding disaster, a company in Tennessee stands out.

Remotec Inc., a subsidiary of Northrop Grumman Corporation, manufactures a fleet of unmanned hazardous duty robots in its Andros line of platforms. Remotec began operations as a private company in 1980 in Oak Ridge to provide remote handling for nuclear materials. The company expanded to areas outside of the nuclear field and purchased the Andros technology from a UK company in 1986. In 1996, it became a subsidiary of Northrop Grumman. For more than 25 years, Remotec has served the military, explosive ordnance disposal units, hazardous materials units, and other first responders as a leading provider of mobile robotic systems for application into a variety of undesirable, hazardous, and potentially life-threatening environments.

There are five unique robots in the fleet that are comparable in size from a child's wagon all the way up to a skid-steer loader. Designed primarily for EOD (Explosive Ordinance Disposal), the lineup is also available for Hazmat, tactical, and CBRNE (chemical, biological, radiological, nuclear, and high-yield explosive) uses. You may have seen the HD-1, in the opening scene of the Academy Award-winning film "The Hurt Locker," or possibly delivering the game ball in the 2010 Military Bowl. Coincidentally, the Andros robots were the inspiration for the main character in the Walt Disney Pixar film "Wall-E."

Ogura Industrial Corporation provides four brakes on the Andros HD Series, the successor to the HD-1. The most versatile and lightweight robot in the fleet, the HD features three cameras, including a pan/tilt surveillance color camera with a 216:1 zoom, a black and white rear-facing camera, and an arm-mounted LED light. The Andros robot also features an option for a weapons camera, as well as a laser sighting system. The Andros robot is capable of speeds of up to 4.3 miles per hour and can travel a distance of 100 meters in 45 seconds. Weighing in at 40 lb, it can maneuver through mud, snow, and sand, as well as rough terrain and paved surfaces. An operator can navigate the robot through openings as small as 26 inches wide and 31 inches high and over obstacles 8 inches tall. The robotic "hand" or gripper can open to 6 inches and has a vertical reach of over 6 feet, as well as having the

The HD1 can travel at speeds up to 4.3 mph and easily maneuvers through openings up to 26 inches wide and 31 inches high.

Source: Ogura

capability to reach beneath automobiles. Tracked front and rear articulators make the HD capable of climbing stairs at over 45 degrees. The powerful rolling wrist and gripper of the Andros HD-2 is able to lift and maneuver heavy objects up to 125 lb, such as a 155 mm artillery shell. As such, the upgraded fleet of Andros HD-1 Unmanned Ground Vehicles (UGVs) now helps to counter evolving threats from improvised explosive devices (IEDs). The manipulator arm's end segment also features a Quick Release technology, which allows the operator to change the arm's end tools on the fly, in the field.

When Remotec was searching for the best brake for their application, Ogura engineering responded with a series of questions that helped fine tune a brake for the specific application. These questions are:

- For what purpose will the brake be used? A brake is used for two reasons: to stop or hold a rotating load. While this may seem to be a very elementary concept, it is critical to specify the intended use when choosing the correct model. Minor design and component differences such as friction disc material and spring force are considered when determining the correct brake for the application. A brake can be specifically designed to dynamically stop a load, to simply hold a load in place, or do both. The wrong choice can mean premature brake failure or worse, a catastrophic system failure — envision an elevator with a misapplied brake.
- How often will the brake be used and what is its expected life? Factors such as life expectancy and heat buildup in a high cycle rate application will determine the appropriate friction material.
- In what type of environment will the brake operate? Relative humidity, exposure to the elements, use in food machinery, and other environmental aspects all have an impact on how the brake will function.
- Envelope dimensions/size constraints: these parameters will determine the size and shape of the brake.

Tracked articulators make the HD capable of navigating rough terrain, climbing stairs at over 45 degrees and over objects 8 inches tall.

• Is a manual release required? In some cases it is necessary to release the brake in an emergency situation. An example is a powered wheelchair that loses its battery charge. In this instance the operator would necessarily have to release the brake to allow the wheels to rotate.

Size is critical for Remotec's application and they wanted to have a very thin profile brake. Based on Remotec's requirements, Ogura RNB series was chosen. This series is primarily designed for holding, but can accommodate emergency stops. Each rotating portion of the robot uses an Ogura brake. There is one brake used in the shoulder, elbow, and wrist of the robot. The brake is attached to the back end of a servo motor/gearbox, which controls the movement of each section.

The Ogura RNB brake is primarily used for holding a load in place. When the servomotor is running, the brake field is energized, so a magnetic field is generated, attracting the steel pressure plate. When the pressure plate is pulled toward the field, it compresses six small coil springs. This releases pressure against the friction disc in the brake. The hub on that disc is connected to the motor shaft, so as long as power is applied to the brake, the motor can spin freely in either direction. When the motor is no longer required to turn and reaches zero rpm, voltage is no longer applied to the field, so the six coil springs push on the pressure plate which, in turn, pushes on the friction disc that is attached to the hub on the motor shaft holding the motor/reducer in place. If the robot was handling a heavy load and there were no brakes, the load may have the ability to back drive the system, causing the load to fall. Obviously, this could be very dangerous, especially if the robot was handling explosives.

The Andros robot is capable of being controlled remotely in a number of ways depending on the method of communication and distance from the target subject. Via a hard tethered cable, it is capable of communication from a distance of 100 meters; with fiber optics over 365 meters, and through a digital radio signal it has a range of up to 1,000 meters. Integrated sensors in the arm joints, articulators, and gripper (HD SXT only) provide instant on-screen position feedback. Since there are so many variables and/or obstacles involved in a mission, the Andros can run for an extended time. It is capable of over four hours of operation.

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