

## Electric Manipulator

The remote systems manufacturer CSIP has recently developed a novel all-electric manipulator arm. Tests have shown that it can do everything a hydraulic arm of a similar specification and has a number of other advantages.

"Most of the new vehicles are all electric and so we have developed electrical manipulator match the capabilities of the entire ROV system" said CSIP managing director Simon Gilligan.

Almost all manipulators are currently hydraulic. This requires a pump and valve pack somewhere on the ROV to provide power for the arms. Removing these items decreases the weight of the vehicle. It also removes the possibility of hydraulic fluid leaking out in the case of an accident.

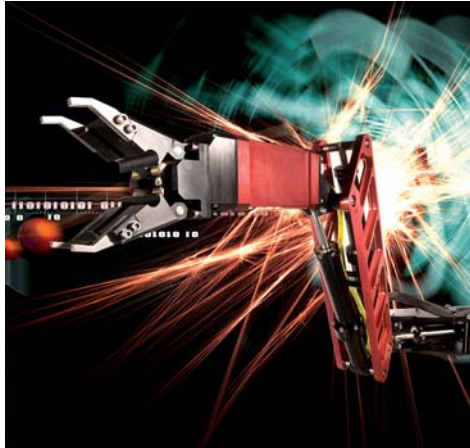
Electrical arms have the same working envelope as their hydraulic counterpart. They can be used for cutting, clearing debris, turning valves etc. The principal advantage, however, is that they are considerably more controllable.

"Most of the hydraulic arms are what are often referred to as *bang-bang* in that they are either on or off. An electrical arm is incremental movement and therefore, much more accurate to drive."

The digital positioning can achieve an accuracy of somewhere around 0.5mm. The computer control electronics knows where the arm is at all times and its exact position can be displayed in three dimensions on screen.

Being digital, it is possible to programme the arm to carry out a specific task or select a task from a function register in the control software. The arm will then automatically perform that operation.

It also has a learning capacity. As its movements are recorded digitally, it is possible to repeat an action precisely. Once users can see what they can do with the arm, CSIP predict that this will open up the possible number of uses.



As the control system knows where the arm is, it is possible to have two arms working together and able to be controlled with greater accuracy. The computer can also set a zone of exclusion to prevent one arm from hitting the other.

"Electric arms have been designed in the past, but it is only fairly recently, that the components have been available to compete with the hydraulic technology," said Simon Gilligan.

"We now have access to the latest generation of extremely powerful electric motors and gearboxes. This has allowed us to create a set of electric actuators that mimic their hydraulic equivalents."

CSIP's new arm has the sort of power that is suitable for the latest large work-class electric ROVs such as Sub Atlantic's Comanche, Schilling's EHD and Sea-Eye's new Jaguar vehicle. The latest design is only a five-function arm but CSIP is considering a seven function electric arm.

One of the issues that would have to be addressed, however, is power availability. On the existing electric actuator, the shoulder has a capacity to lift around a ton. Carrying out this, however, demands a high ampage. At 5amps, the arm will lift 25 kilos while a ton requires 30 amps. The problem is that at the moment, there is not 30 amps available on most vehicles.

"In practice, it is unlikely that most arms would be required to lift a ton and instead of running on 24volts, we could run it on 115 volts and use considerably fewer amps, but to get the best out of the arm, it would be necessary to work together with ROV manufacturers at an early stage."

CSIP can be controlled via range of controls system such as hand grips, joysticks, master/slave arrangements. The arms are also available with various types of jaws, grabbers cutters, parallel jaws and rotating brushes.

One addition that would be relatively simple to install on electrically-operated manipulator jaws is a force feedback mechanism. This could prevent over-gripping and crushing the object to be moved.

"In theory, it would be possible to pick up a egg without difficulty," said Simon Gilligan

