

# Getting A Handle On Improved Telemanipulator Operation

By Amos Avery and Steve Williams

*Redesigned VERSA® VR8 Handle System from DESTACO's Central Research Laboratories possesses design and construction enhancements that benefit the operator while optimizing efficiency*



*The invention of the telemanipulator in the late 1940s ushered in a new era of safety and efficiency in the handling of hazardous materials in a wide array of industries. While telemanipulator design and operation has evolved in the ensuing decades, the look and feel of the handle that is gripped by the operator has remained relatively static. That is ready to change, however, as Central Research Laboratories has completed the development of the new VERSA® VR8 Handle System.*

## Introduction

A persuasive argument can be made that one of the most significant days in the evolution of hazardous-material handling in industrial applications occurred in 1949. That's when inventor Ray Goertz first publicly demonstrated, at the behest of the U.S. Atomic Energy Commission for use at its Argonne National Laboratory, his invention that would come to be known as a "telemanipulator."

During that same era, three scientists from the Massachusetts Institute of Technology founded Central Research Laboratories (CRL) and began working on developing safer methods for handling hazardous and toxic products. This led to CRL's development of command-remote telemanipulators that could be used for the safe and efficient handling of nuclear materials by eliminating the need for the human operator to have direct contact with what could be extremely harmful and hazardous substances.

Since then, CRL has manufactured and installed more than 7,800 telemanipulators in 22 countries. CRL strives to continually improve and develop innovative transfer systems, glove ports, telemanipulator tools and power-assist equipment technologies that help their end users achieve the highest level of performance. Every telemanipulator that CRL manufactures is designed for the specific needs of the user and takes into account many varying factors in developing the most customized solution available.

With that commitment in mind, in the ensuing decades the design and operation of telemanipulators have undergone a series of technical enhancements and improvements.

Surprisingly, though, one critical component of the telemanipulator has been relatively immune to change – the handle that the operator grips and manipulates to complete the precise movements of the telemanipulator.



*The VERSA® VR8 Handle System features many new user-friendly features, including a redesigned hilt, swiveling finger loops, additional finger grips and knobs for two-handed control, and multiple adjustment points that can more easily accommodate different-sized hands.*

Since the invention of the first telemanipulators, the handle design has stayed roughly the same, though there have been calls for its refinement. This article will illustrate what the challenges have traditionally been in telemanipulator operation and construction and how a new handle design can help improve performance in those areas.

## The Challenge

When considering the capabilities of the handle of a telemanipulator, there are two main areas of focus: the operational element and the construction element.

From a design standpoint, most common telemanipulator handles – which employ what is known in the industry as an “opposed-grip” or “ambidextrous-style” handle – have been around since the late 1950s, with very few modifications made in the way they are designed and operate in that time. However, in recent years, increased global scrutiny has been placed on how ergonomically friendly a piece of equipment may be, which prompted CRL to design a more ergonomic handle.

In considering the operation of traditional telemanipulators, the ergonomic shortcomings of their handles could be traced back to these design factors:

- The actual length of the handle may not be sufficient and could be modified in order to deliver better feel and stability for the user
- The “tang,” or hilt, at the top of the grip could be too pointed and did not always conform to the shape of the hand
- Operators who would use two hands on the telemanipulator as a way to reinforce grip strength or to handle heavier loads would encounter areas on the top of the handle where the hand could come into contact with moving components
- The activation buttons on the handle could be small or have sharp edges, which would put stress on the fingers
- The finger loops on the handle were adjustable, but would not swivel, which would limit their range of motion and overall adjustability

It was noted that some telemanipulator operators would attempt to modify the handle themselves, which would both reduce the effectiveness of the telemanipulator and make them less safe for the operator to use.

The way the telemanipulator handle was constructed also could have deleterious effects on its operation in relation to manufacturing, maintenance and downtime costs:

- The telemanipulator’s electrical system is controlled by micro-switches that would have to be hard-wired via soldering into the unit’s handle
- Traditional handles require a series of special tools to assemble and maintain them, including specific types of screwdrivers, Allen wrenches and snap-ring pliers
- The handle is typically bolted to the end of the telemanipulator, which requires time and tools if the handle needs to be removed

The challenge, then, was to acknowledge these trouble areas in current telemanipulator handle design and come up with an alternative that improves the experience for the operator, while also optimizing the unit’s construction.

## The Solution

So, when the call for a redesign of the telemanipulator handle was made, CRL – which aligned in 2009 with automation, workholding and containment-solutions provider DESTACO, Auburn Hills, MI, a Dover company – stood ready to answer the challenge.



First, extensive field research and focus-group studies were conducted in order to gain insight into the handle's use and potential ways to improve the design. CRL also contracted with SRI•Ergonomics at The Ohio State University in Columbus, OH, to test and assess the viability of potential new handle designs. SRI•Ergonomics' review took into account eight ergonomic principles of hand-tool design:

- Grip Type
- Handle Shape
- Handle Diameter
- Handle Length
- Handle Surface
- Handle Material
- Sharp Edges
- Function

After completing testing in early 2016, SRI•Ergonomics provided feedback to CRL on how to best design further

iterations for this new handle. Armed with this valuable insight and ergonomic assessment data, CRL further refined and ultimately developed the VERSA® VR8 Handle System. This new system met all of the parameters for ergonomic operation in different wrist positions (neutral, palmar flexion, dorsiflexion, radial deviation and ulnar deviation), as well as the versatility that makes it usable by operators with varying hand sizes, dominant-hand orientations and hand-strength levels.

Some highlights of the VERSA VR8 Handle System include:

- A redesigned tang/hilt at the top of the handle that is smaller and more sculpted in order to fit the shape of the hand
- Finger grips on the top and a knob on the front that make it easier and safer to hold and control in two-handed applications
- Finger loops that are on swivels, which allows the operator to retain more consistent grip pressure during all ranges of motion



## EVOLUTION OF THE HANDLE

Current Production Handle	VR2 - VR3 First attempts at improvement	VR4 - VR7 Major improvements implemented	VR8
<ul style="list-style-type: none"> <li>• Developed in the late 1950s</li> <li>• Basic design has remained unchanged and in production for more than 60 years</li> </ul>	<ul style="list-style-type: none"> <li>• Tapered handle with wide Duck Bill for hand comfort</li> <li>• Grip Knob for second-hand stability</li> <li>• Based entirely on 1950s design with minor changes</li> <li>• Good ideas, but never made it to production</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced assembly time and reduced assembly tools</li> <li>• Common parts throughout</li> <li>• No-Solder Electrical maintenance</li> <li>• Additional grip points for increased control</li> <li>• Backward compatibility with 1950s model</li> </ul>	<ul style="list-style-type: none"> <li>• Ergonomic Study issues addressed and incorporated</li> <li>• Removable, Maintainable, Adjustable Design</li> </ul>



*The VERSA® VR8 Handle System*

- Multiple adjustment points that can accommodate different-sized hands with an adjustment range of 1", as opposed to the 0.5" range in legacy handles

On top of the ergonomic benefits, the VERSA VR8's electrical components have connectors, which eliminate the need for soldering and means that each switch can be independently removed and replaced. Additionally, in response to consumer feedback, more uniform, maintenance-friendly fasteners have been used, which makes any maintenance work that needs to be done easier to complete. Uniformly sized pivot pins with a special spring-loaded clip, which allows all of them to be inserted and removed by hand, have also replaced all of the snap rings in the handle's construction.

Finally, rather than having the handle bolted to the telemanipulator, the VERSA VR8 is attached via a quick-release clamp and tong cable coupling that can be undone by hand. This will help drastically cut maintenance times since no soldering will need to be undone and multiple tools will not be required to remove the handle. If maintenance is needed, the handle can just be popped off and replaced with a spare in a matter of seconds, which will eliminate any appreciable downtime for the telemanipulator. The handle's snap-on, snap-off ability also means that there may come a day when each operator – who all have different hand sizes and shapes – will have his or her own personal handle that can be swapped out with the handle of the departing person during a shift change, which again will reduce downtime and result in more efficient and ergonomically friendly operations.

## Conclusion

The current iteration of most of history's greatest inventions bare scant resemblance to their version 1.0 – think of

automobiles, cell phones and personal computers, for example. Somehow, though, telemanipulator handles went decades without any significant changes in their design. The call for design modifications, however, gained steam in recent years as ergonomic concerns became more pronounced, while the awareness of claims of repetitive-stress injuries became more common.

As a longtime developer and manufacturer of telemanipulator systems, CRL heard the calls for a better design and, working with the experts at SRI•Ergonomics, set about to answer the industry's need for a more ergonomic telemanipulator handle. The result of this commitment is the VERSA VR8 Handle System, which stands ready to be a next-generation solution to all telemanipulator user and operations concerns.

### About The Authors:

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*Founded in 1915 as the Detroit Stamping Company, DESTACO is now the industry's leading global supplier of high-performance automation, workholding and containment solutions, and focuses on helping manufacturers improve precision and productivity. DESTACO's product line includes end effectors, grippers, indexers, manual and power clamps, slides, conveyors, robotic-tooling solutions, remote-handling products, and containment solutions. The company operates globally with locations in more than 10 countries in all key regions of the world. DESTACO is part of the Engineered Systems market segment within Dover Corporation. For more information, please visit [destaco.com](http://destaco.com) or [dovercorporation.com](http://dovercorporation.com).*

