Telemanipulators - Enhancing Yesterday’s Technology To Perform Today’s Tasks

HUBERT HAFEN AUTHOR, JEAN-MICHEL WAGNER AUTHOR

Wälischmiller Engineering GmbH
Schießstattweg 16, 88677 Markdorf, Germany
Introduction - What does Wälischmiller Do?

- Remote handling solutions over 60 years worldwide
- Application in nuclear and chemical industries
- Mechanical telemanipulators
- Remote-controlled power manipulators
- Robot system TELBOT®
- Certified according ISO 9001:2008, KTA 1401 and ATEX
Famed economist Joseph Schumpeter summarises that creative destruction describes the "process of industrial mutation that incessantly revolutionises the economic structure from within, incessantly destroying the old one, incessantly creating a new one".

In the same manner, remote handling technology has improved in the last decades. Mechanical design improvements, complex robotic functions and force feedback are examples of progress in the sector.

New challenges in the nuclear industry influence tasks performed in hot cells. This evolution raised key questions: How can hot cells be used on a long-term basis and how can functional improvements be integrated at lower costs to increase the cost effectiveness?
Upgrade of Telemanipulators with Electrical Driven Manipulators
Electrical Driven Manipulators

- **Arm length:** 2 m to 4.5 m
- **Capacity:** 20 kg in all positions and 40 kg within limited range with load hook
- Electrically driven manipulators are composed of a drive unit with servo motors that can be mounted directly on the slave-arm or on the through-wall tube of a telemanipulator (easy connection / disconnection)
Upgrade with Electrical Driven Manipulators

- Electrically driven manipulators allow operators to drive the telemanipulator systems they are accustomed via operator console
- Increased capacities and minimised operator fatigue
- The work can take place in a secure area with a controller and a visualisation system.
Upgrade with Electrical Driven Manipulators

- Robotic function
- Various operating control systems: joint by joint, master arm and JOYARM
- The position feedback allows the user to teach and repeat sensitive moves (GoTo-Mode) and program hard and soft keep out zones for the manipulator (3-D visualisation system)
- The productivity is increased and the fatigue of the operators is reduced.
Installation of New Electrical Driven Power Manipulators in Through-wall Tubes for Telemanipulators
Upgrade with Power Manipulators

- Mature technologies allow for powered manipulators to be inserted through existing hot cell liners
- The size reduction and the improvement of drive units allow an installation in confined places
- Power manipulators installed in a liner tube as replacement of mechanical telemanipulators offer advantages in increased capacity, user-friendly operation and increase of operator’s safety

Arm length: 4 m
Capacity: 30 kg
Upgrade with Power Manipulators

- Hydraulics systems are adapted for rough works without precision
- Electrical power manipulators can be driven smoothly and precisely with steplessly variable speeds
- Hydraulics systems loss fluid which leads to less efficiency and cleanliness problems
Upgrade with Power Manipulators

- Electromechanical systems allow for drive mechanisms to be installed on the cold side of the hot cell minimising impacts of radiation (TELBOT®)
- The use of radiation hardened position feedback hardware has enabled controls enhancements

Arm length: 3.5 m
Capacity: 100 kg
TELBOT® and Masterarm

Arm length: 2.7 m
Capacity: 100 kg

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TELBOT® and Masterarm
Example of TELBOT® Deployment

Arm length: 6.4 m

Capacity: 10 kg (camera for inspection and wash lance for cleaning inside the arm)

First robot worldwide certified ATEX category 1 zone 0
Advancements in Control Systems
Advancements in Control Systems

- Force feedback allows the user to receive information about the amount of force being applied by the manipulator
- Position feedback allows the user to teach and repeat sensitive moves and program hard and soft keep out zones for the manipulator
- Kinematic control algorithms now allow users to control manipulator in varied frameworks – Cartesian, spherical, cylindrical, joint by joint
- Advanced control algorithms take into account system spring and dampening coefficients
Conclusion

- “Creative Destruction” goes on in remote handling and robotics
- “Teach an old manipulator new tricks”
- Game changer: developing technology which allows a vendor to use an older remote handling equipment for a new task; or achieve great cost and time savings on a current project
- Many very difficult remediation challenges will require the next generation of remote handling and robotics to achieve success.
- Retrieval, transport, reprocessing and ultimate disposal of radioactive material must employ remote solutions to protect the work force and the environment. The solutions must me rugged, reliable, and nimble.
- Enter in the next stages of decommissioning; we must look for new solutions and equipment that meet the precise need of the situation and protect the workers and the environment in new and effective ways.
Thank you for your attention