

In - Bay Fuel Inspection Hand Tool System



Stern Laboratories manufactures a range of hand tools for bundle disassembly and inspection in the spent fuel storage bay. Our modular system consists of the following components:

Handle

All tools share a common, ergonomic handle complete with locking actuator. The handle is easily maneuvered, weighing only 15 lbs in water. For lifting heavy loads, an overhead crane hoop is provided.

Tool Rack

A rack holds all seven tool heads neatly. The tool heads can be engaged and disengaged from the handle with a sim-

ple push and quarter turn.

Pry Tool

The pry tool incorporates a flat screwdriver, useful for breaking out elements from bundles. The screwdriver is made from a hardened, nickel plated steel, and is replaceable.

Locking Plier Tools

Two locking plier tools are provided - one with curved jaws, and one with needle nosed jaws, made from commercially available stainless steel pliers.

Brush Tool

The brush tool uses two stainless steel strip brushes to clean deposits or

debris from fuel bundles, camera lenses, or other surfaces

Element Gripper

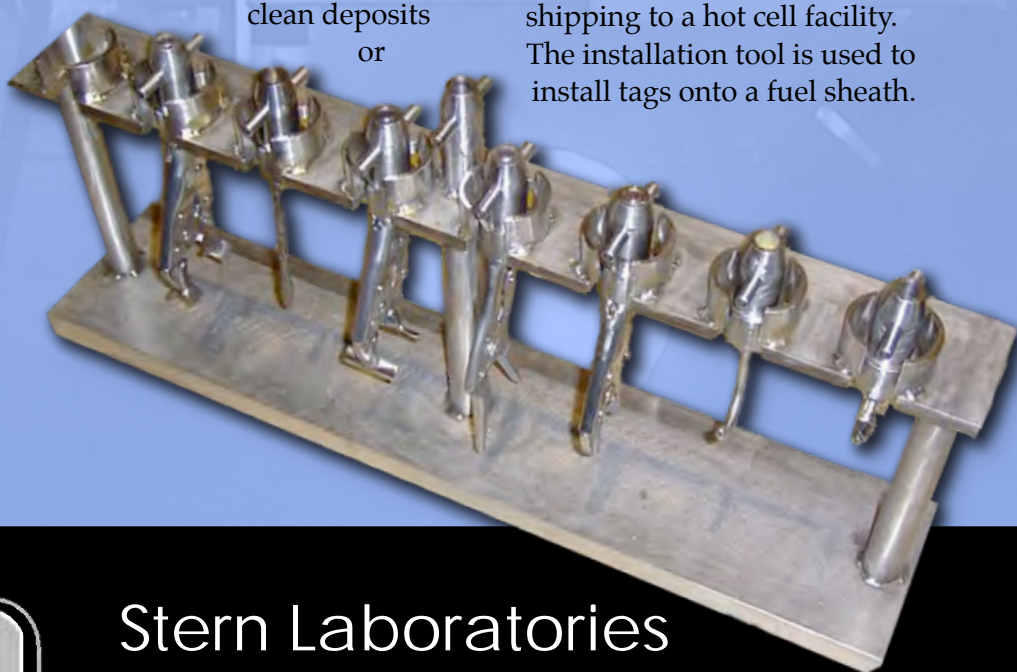
The element gripper can grasp fuel elements which have been broken out of a bundle and transfer them to an inspection station or storage rack with minimal damage to the sheath.

Hook Tool

The hook tool is simple, but indispensable for retrieving, moving or lifting items on the inspection platform.

Tag Tool

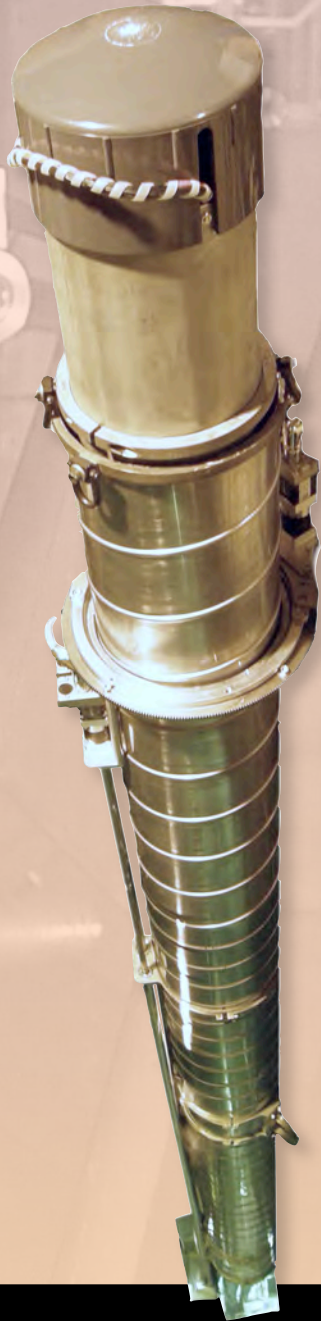
Tags identify elements being removed from a bundle for shipping to a hot cell facility. The installation tool is used to install tags onto a fuel sheath.



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In - Bay Fuel Inspection Light Pipe Camera



The "Light Pipe" camera system is a new product from Stern Laboratories. The system provides fuel inspectors with high resolution video for carrying out visual inspections on spent fuel and other activities such as bundle disassembly in fuel bays. at Candu nuclear reactors.

By using a long telephoto lens, and pivoting underwater mirror, the Light Pipe design achieves high magnification, while keeping the camera far enough away from the bundle to avoid radiation damage and allow

easy maintenance and upgrades. The system is intended to replace the periscopes and underwater cameras currently used for fuel inspection, providing superior image quality and operational flexibility at a significantly reduced capital and maintenance cost.

Stern Labs also manufactures high intensity underwater light fixtures and a range of resolution and colour test targets



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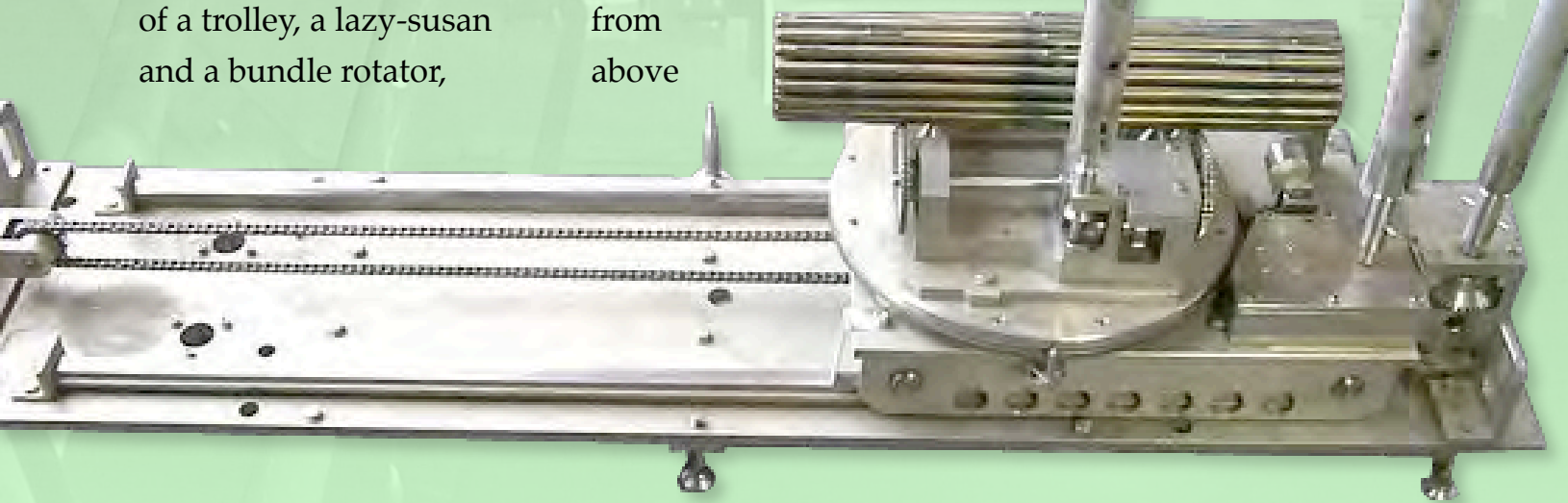
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In-Bay Fuel Inspection Motorized Bundle Manipulator

The bundle manipulator provides a means of supporting and manipulating an irradiated bundle or element at the bottom of the fuel bay such that its full outer surface can be safely inspected using a camera or periscope. It also provides a support platform for disassembling bundles. It consists of a trolley, a lazy-susan and a bundle rotator,

which enables an inspector to traverse the bundle back and forth and to be rotated in the horizontal and vertical planes. The bundle rotator can be replaced with an element rotator, which enables a single element to be inspected. The axial and rotational motions are driven from above

by computer controlled motors using long drive shafts which attach to T-shafts on the manipulator.



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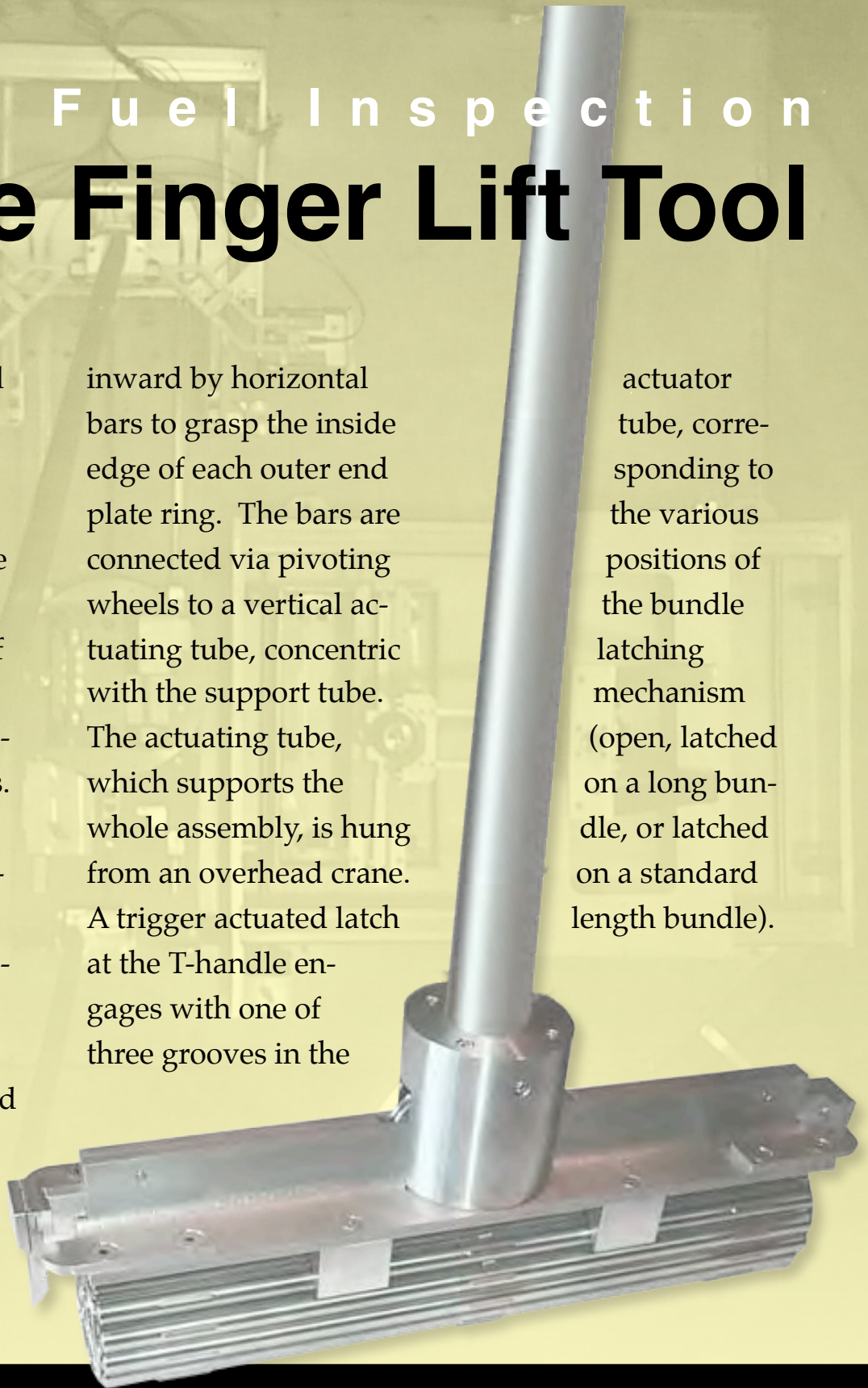
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In - Bay Fuel Inspection Bundle Finger Lift Tool

The bundle finger tool is used to pick up and move bundles from holding trays and/or modules to the bundle rotator in the fuel bay. The unique method of latching on to the end plates minimizes damage to the fuel sheaths. It consists of a long support tube with a T-handle at the top end and a grasping mechanism at the bottom. Two saddles align the tool on the bundle, and two opposing sets of three spring-loaded latches are pulled

inward by horizontal bars to grasp the inside edge of each outer end plate ring. The bars are connected via pivoting wheels to a vertical actuating tube, concentric with the support tube. The actuating tube, which supports the whole assembly, is hung from an overhead crane. A trigger actuated latch at the T-handle engages with one of three grooves in the

actuator tube, corresponding to the various positions of the bundle latching mechanism (open, latched on a long bundle, or latched on a standard length bundle).

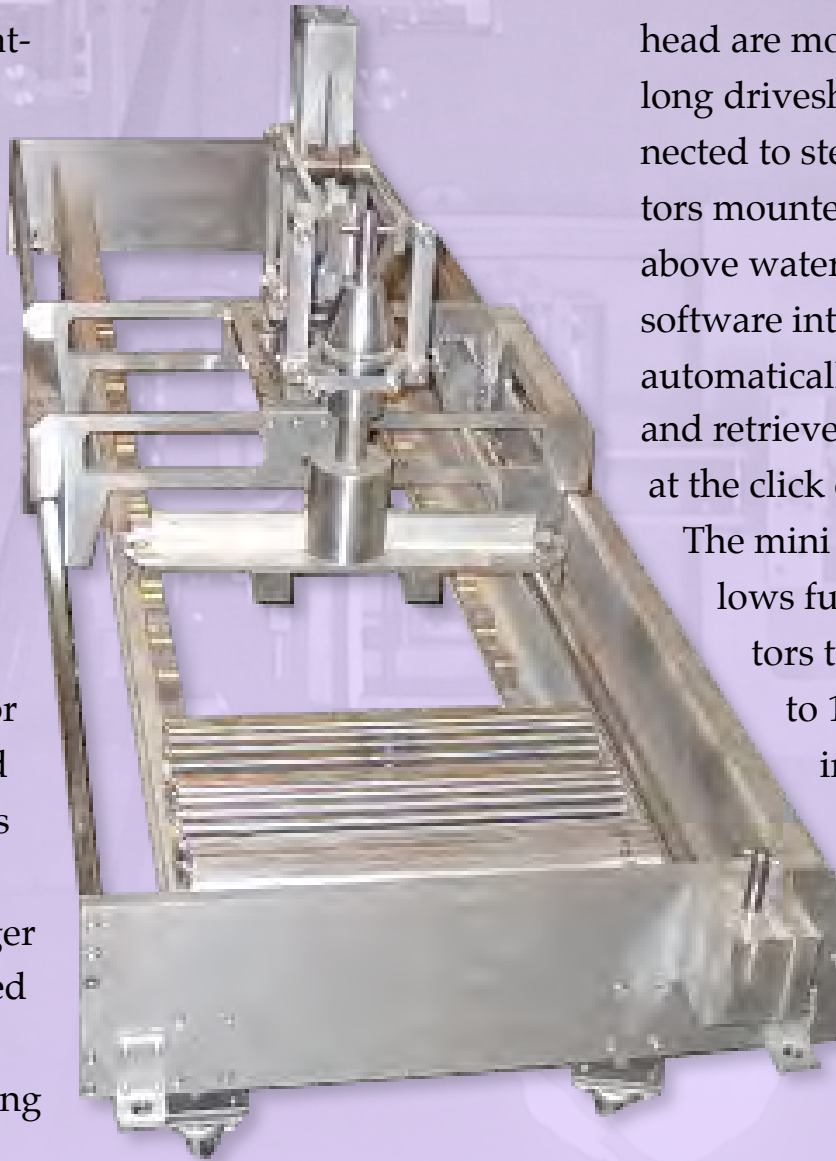


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In-Bay Fuel Inspection Mini - Gantry

The Mini-Gantry attaches to the side of the bundle manipulator on the fuel inspection table in the spent fuel bay at Candu Reactors. Its tray accommodates 16 bundles which can be picked up, placed on the manipulator rotator chains, and returned by means of a lifting head (based on the Finger Tool design) carried by a mobile crane. The crane and lifting



head are moved via long driveshafts connected to stepper motors mounted above the above water line. A software interface automatically selects and retrieves a bundle at the click of a button.

The mini gantry allows fuel inspectors to inspect up to 16 bundles in one shift without having to interrupt fuel-handling personnel.

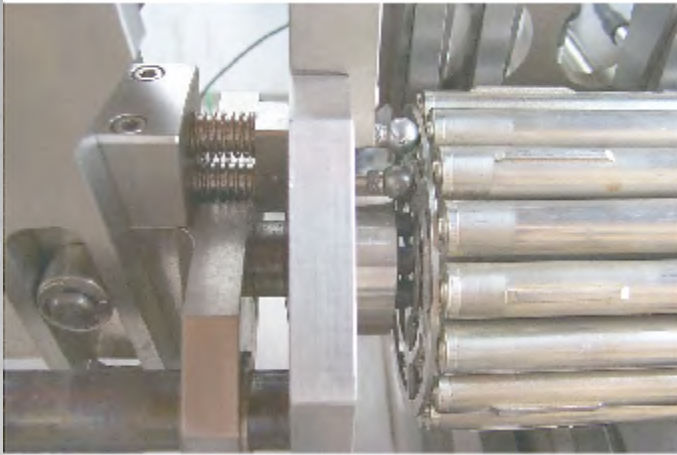


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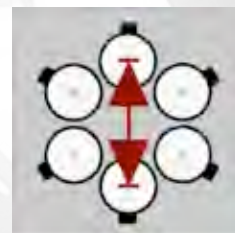
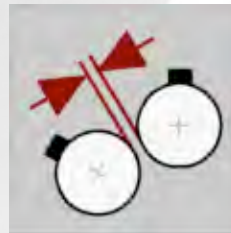
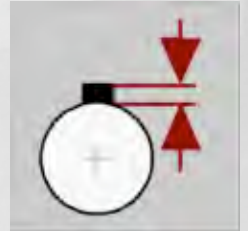
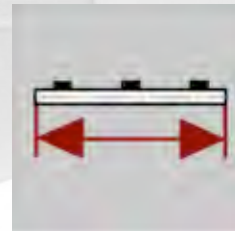
F.E.M.E.R



The Fuel Envelope MEasuring Rig (FEMER) was designed as a cost effective means of augmenting fuel inspection operations with the ability to measure the outer envelope of a spent fuel bundle to determine its length, element bow, bearing pad wear, and end plate deformation. In operation, the FEMER rests on the inspection table at the bottom of a fuel bay and attaches to

the end of a bundle manipulator. Its main features are positioning devices which centre and align the bundle and a pair of rotating latches attached to pivoting arms which grip the end plates, lift the bundle off of the manipulator and rotate it against an array of displacement probes. Ten Linear Variable Differential Transformers (LVDTs) aligned perpendicular to the bundle axis measure the surface of the outer ele-

ments and four LVDTs, two at each end, contact and measure the profiles of the outer and middle end plate rings as the bundle is rotated. The latching/lift and bundle rotation motions are driven from above by computer controlled motors. After a scan is performed, the bundle dimensions are calculated and displayed in a control and analysis window.



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