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## **LUHR JENSEN FISHES FOR MANUFACTURING IMPROVEMENTS**

How do you modify the manufacturing process for a world-renowned fishing lure, with a long-standing reputation for catching fish, celebrating 80 years of success? Very carefully is the answer. Fishermen are a cautious and conservative group by nature. While they are always eager to try new things, they don't automatically accept change to proven products. Fishing tackle manufacturer Luhr Jensen of Hood River, Oregon faced this challenge when they realized they had to improve ergonomic and safety issues in the production of Silver Minnow™ lures. Luhr Jensen and Sons is a company known world wide for its quality fishing lures and accessories. With its start in an unused chicken coop on a depression-ridden fruit ranch in 1932, the company thrives with 250 employees and over \$12 million in sales. The product they developed is of interest to any organization with welding and soldering tasks.

The mostly manual process of manufacturing the 'Silver Minnow' raised several health and safety issues. These included close proximity to solder and flux fumes, handling open containers of acid flux, handling solder with flux residue, and close proximity to the heating flame. Physical demands contributed to risk of musculo-skeletal injury. Prolonged, static positioning was an issue due to standing in place at the soldering fixture. Manipulating solder strips with tweezers caused awkward postures, particularly wrist flexion, extension, supination and pronation, plus neck flexion. This task also resulted in repetitive motion issues due to the large number of completed units (4-5 per minute). Sustained muscle loading of the shoulders, forearms, hands and fingers to reach and operate tweezers and pressure points with hard metal tweezers against soft tissues of hand and fingers were also concerns.

Several efforts were made to address the issues. None were satisfactory. A "U" shape wire form was tested, however this required special machinery and still required manual placement. A prototype automatic wire solder feeder was designed and built, but this proved to be too complicated.

Luhr Jensen's Engineering and Maintenance Departments have a long history of designing equipment and improving processes to improve quality, reduce worker fatigue and improve health and safety. They applied for and received a grant from the Oregon Department of Consumer and Business Services. The Oregon OSHA (OR-OSHA) Worksite Redesign program provided the funding, for which Luhr Jensen had to provide a minimum 10% match. They contracted with a strategic partner, the Oregon Manufacturing Extension Partnership (OMEP) to manage the program. OMEP's project managers have a mission to increase Oregon manufacturers' productivity and profitability and are very experienced in management of OR-OSHA development projects, particularly the grant applications and necessary evaluations to measure success of the end result. An ergonomics evaluation created a baseline assessment at the start of the project.

OMEP: Luhr Jensen

This was compared to a final assessment with a detailed report documenting the change in risk of worker injury.

Several requirements were defined for the solution. Foremost was elimination of exposure to flux and the manual handling of flux. Next was elimination of the repetitive handling and placement of precut solder with a requirement for improved consistency and quality of solder joints. Finally a preference was expressed for the use of natural gas that is cleaner burning and less expensive than the propane used at the current time. The solution was not to result in diminished production. The proposal recommended building a soldering workstation that would eliminate the exposure to and handling of flux, proximity to heating flame and repetitive handling and placement of solder strips. The device was to be efficient, simple to operate and not create additional MSD risk factors.

The end product is a semi-automated hook soldering workstation that uses solder paste which combines the previously separate solder and flux and allows the material to be bulk fed with accurate metering and placement through a pumping system. The workstation is a customized machine from Fusion Inc. of Willoughby, Ohio designed to support this particular application. The workstation performs the solder placement and heating tasks in an enclosed, ventilated chamber. It is glass-enclosed on all four sides and opens on the front side for loading and unloading fixtures (opening extends from the table surface up 22.5"). The machine consists of a 12 station rotary index. Each station has an adjustable fixture to accommodate 5 different sizes of Silver Minnow lures. Once a station is manually loaded with a metal "spoon" and hook, the index table automatically advances through a paste dispense, natural gas torch, air-cooling, water rinse and final air blow off before manual unload and reload. The machine has an Allen-Bradley PLC to control all functions. The machine has a 48" X 48" footprint with the table 32.25" high. Employees stand on rubber anti-fatigue matting in front of the workstation. They wear cotton gloves covered with latex gloves while handling the lures.

One worker now stands in front of the workstation and places a lure blade in a fixture along with a hook at the 6 or 7 o'clock position. The previously soldered weed guard (wire) is then pressed downward slightly with the thumb (bent) into proper alignment. The indexing table rotates clockwise to enter the automatic solder paste dispense process and then subsequent reflow (heating), air blow-off and water cool down stations. Completed (soldered) lures are then removed and inspected (at the 5 or 6 o'clock position) as they rotate around from the right side. The completed lure is then attached in a chain of several lures to hang on a rack just to the left of the workstation. The change has eliminated the need for an employee to manually place solder with tweezers into the blade of the lure.

An ergonomic evaluation determined satisfaction with original requirements, significantly reducing the risk of employee injury. The ergonomic risk factors and health/safety issues have been completely eliminated. The full surround

guarding and ventilation hood also enhanced worker health and safety. Other operational efficiencies were found. Significantly increased production allowed an operator to be moved to pre-production support. Additionally, the quality of the joint between the spoon and the hook has been improved and material costs are controlled.

Dave Lind, Engineering Supervisor for Luhr-Jensen, is very pleased with the results. Enthusiastic about the OR-OSHA Worksite Redesign program, Mr. Lind recommends that other companies consider the program. Mark Biederbeck, OMEP's Manufacturing Consultant, notes the satisfaction in many areas from a project such as this. Reducing the risk of employee injury is a key priority for most companies, and usually other benefits arise offsetting many development costs.

Oregon OSHA's (OR-OSHA) program provided up to \$107,122 in grant monies but only approximately 85% of this was used. This covered the costs of design, development and ergonomic evaluation of the workstation. Luhr Jensen contributed well in excess of the required 10% match in material and in-kind services. This product was designed for this particular application, but the concept could be of use to anyone with soldering and welding tasks.

All products developed through this program are public property. The design is complete, and will be freely available to anyone wishing to duplicate or further develop the mobile lift. A web based project archive is in the process of being constructed, that will provide details on this and many of the 35 to 40 grants being completed. It will be linked from the main Oregon OSHA website and will provide information such as project overviews, ergonomic reports on the projects, as well as design and vendor information so that anyone may research the results and adopt the technologies.

Information about developments and the status of this program can be obtained from Oregon OSHA ([www.orosha.org](http://www.orosha.org)).

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