

## **Window 20M Cleaning Tool**

Contact: Jesse Kappmeyer, Idaho National Laboratory

### **Background**

The Hot Fuel Examination Facility (HFEF) at the Idaho National Laboratory (INL) is a large hot cell facility with a mission of receiving, sizing, and examining irradiated nuclear fuel with the goal to further understand the material properties of different fuel designs. The hot cell is a 70ft x 30ft cell with 4ft thick concrete walls. Four-foot-thick viewing windows are situated around the hot cell to allow viewing of operations ongoing in the cell. Research equipment in the hot cell is handled with wall mounted manipulators, bridge mounted manipulators and bridge cranes. No one has entered the hot cell since 1973, so all maintenance activities must be performed remotely.

### **Problem Statement**

The 20M Viewing window at HFEF has become foggy on the inside, likely from salt vapors resulting from a furnace operation. Since the deposits are on the inside of the window, a remotely handled tool needs to be developed to clean the window. To further complicate the project, vertical bars were placed on the inside of this window, likely to protect against impact. All areas, including under the bars, must be cleaned.

### **Deliverables**

The capstone design team will provide the following deliverables:

- 1) A prototype cleaning tool complete with scrubbing heads
- 2) A controller for the tool, either software on a laptop or a control box

### **Design Inputs**

- The scrubbing head needs to be flexible to ensure it maintains contact with the glass.
- The scrubbing head should use a random orbital pattern to avoid “swirls.”
- The tool shall incorporate lifting fixtures compatible with bridge mounted manipulator. INL to provide drawings.
- The tool shall include a camera to assist in positioning the scrubbing head. Camera to be provided by INL.
- Power and controls are to be provided through a tether/cable system.
- The scrubber head should move up and down between the bars. Horizontal movement for positioning to be accomplished using existing in-cell equipment.
- The vertical movement of the scrubber head should be automated to reduce operator fatigue.
- Areas under the bars must be cleaned as well.
- The total weight of the tool shall be less than 150lbs.