

# FLCC HVAC ERGONOMIC TEST FIXTURE REDESIGN PROJECT

**Final Report 2/15/01**

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## **Overview:**

This report summarizes the FLCC HVAC Ergonomic Test Fixture Design and Implementation. The information is presented as follows.

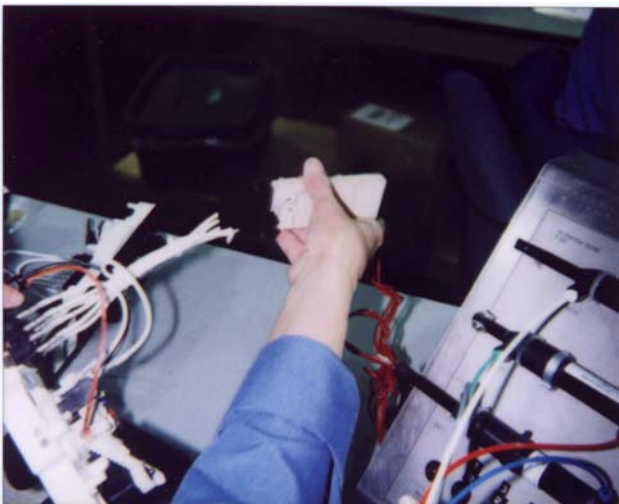
1. Narrative.
2. Fixture Presentation.
3. Features of Design.
4. Ergonomic Evaluation.
5. Cost Effectiveness
6. Project Evaluation.
7. Summary of entire project.

## **1. Narrative.**

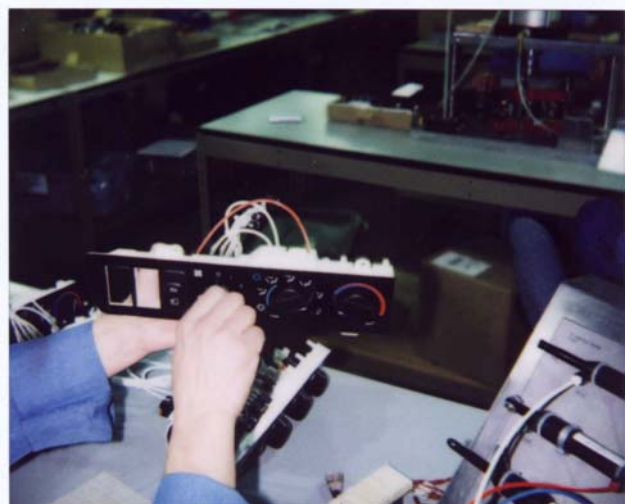
The FLCC HVAC Control test station has for a long time been an ergonomic challenge to the production personnel that test this product. The Goal for this project was to eliminate ninety percent of the ergonomic hazards to the production employees who work at this station.

## **2. Fixture Presentation.**

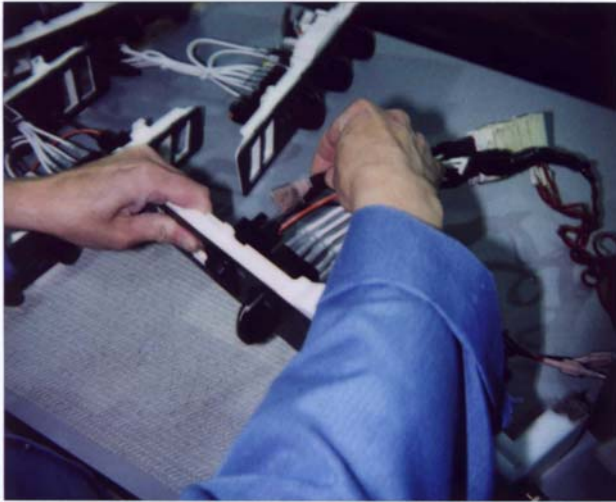
The following pictures show the old method of testing first and then the new method.



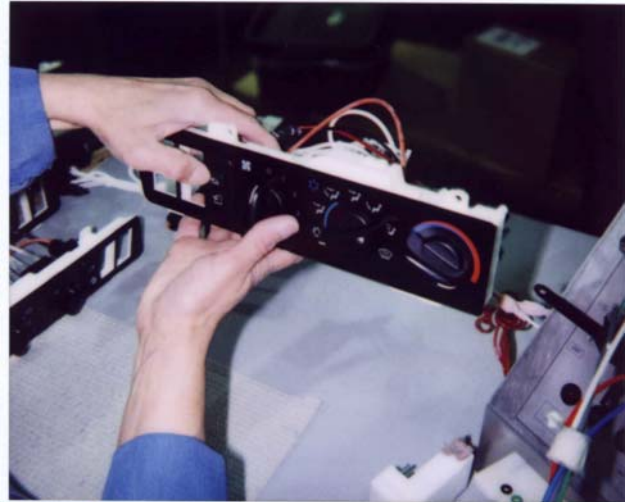
1. Plug in electrical connectors.



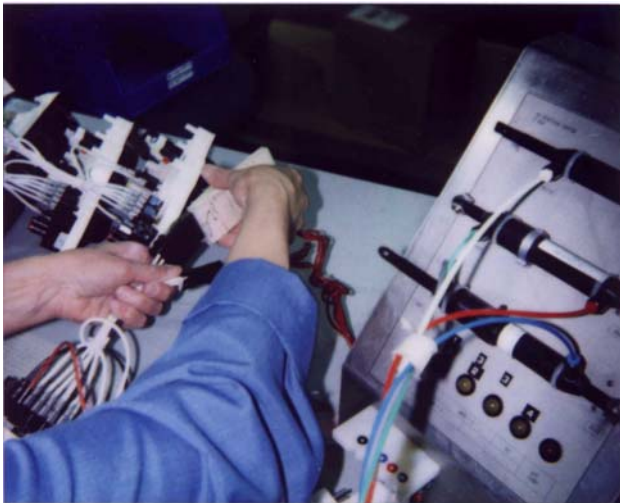
2. Turn fan switch to check for function.



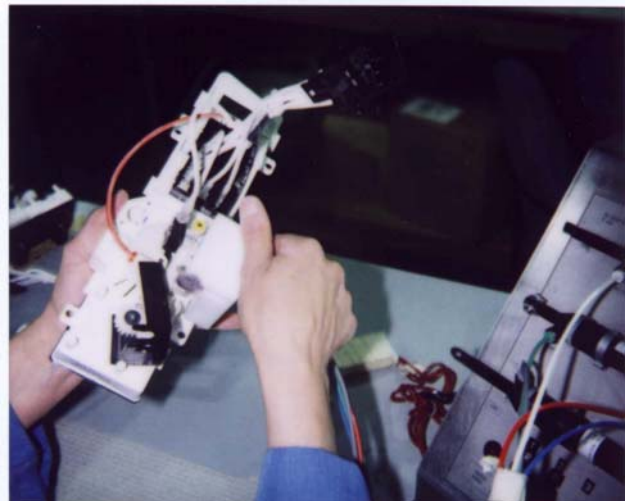
3. Plug in electrical for rocker switch.



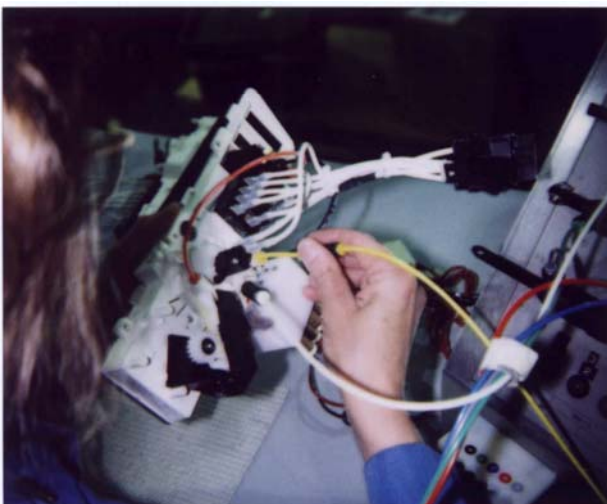
4. Check rocker switch for icon lights.



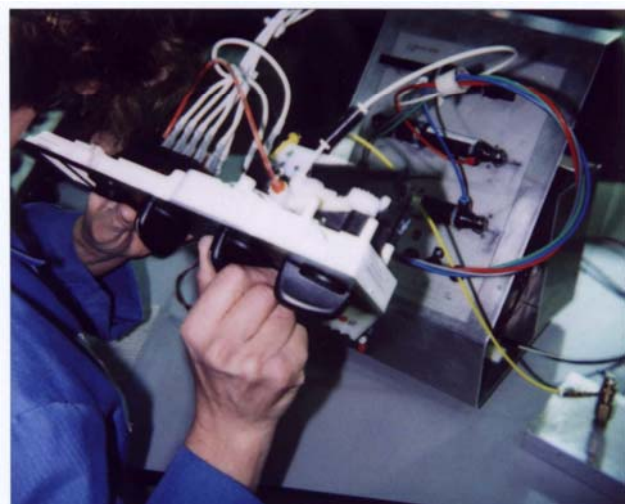
5. Unplug electrical connectors.



6. Plug in air connection block.

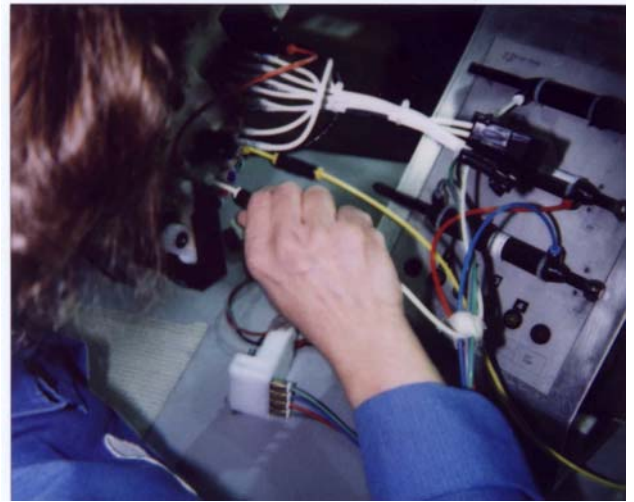
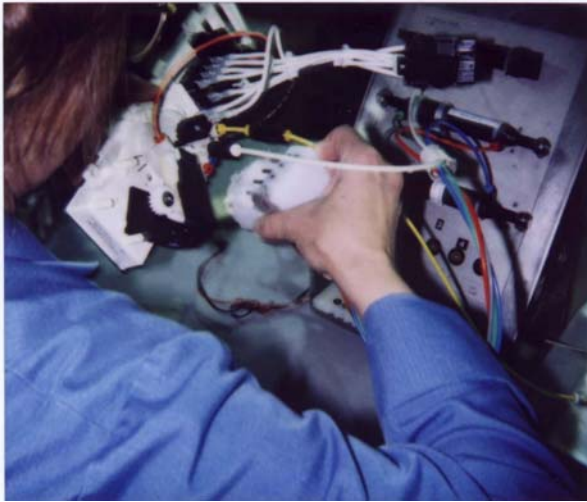


7. Plug in extra air connections.



8. Rotate pneumatic control, listen for leaks and check for function.



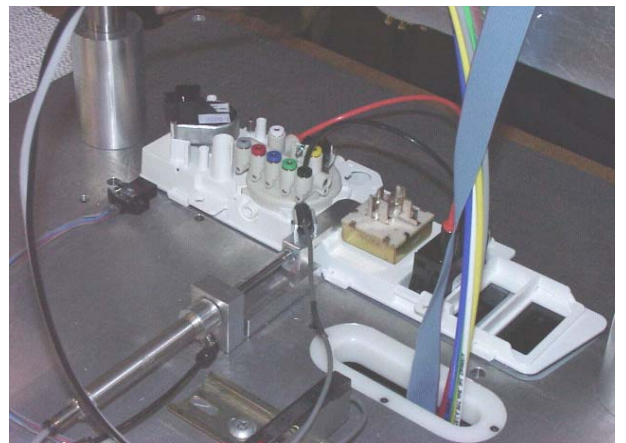


9 &10. Unplug air connections.

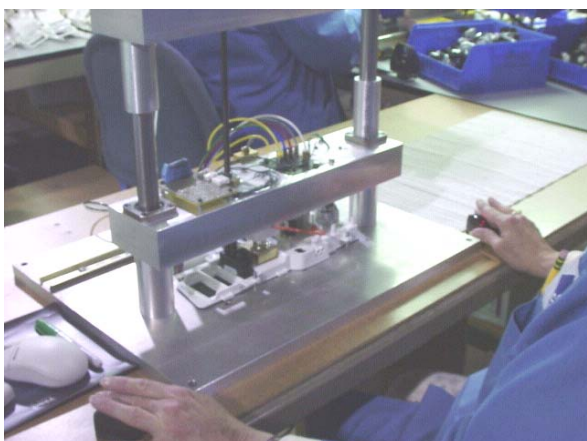
The following pictures show the new method.



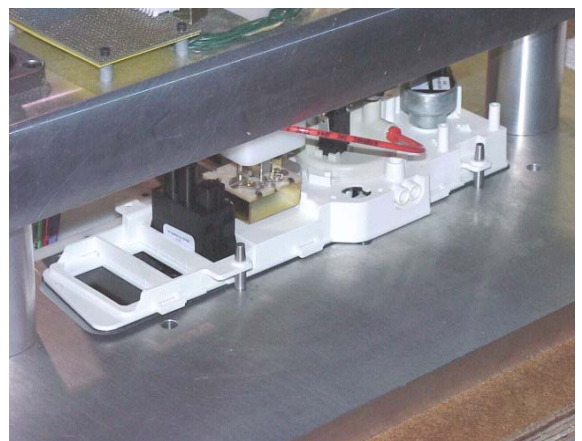
1. The test process starts by placing the control in the fixture.



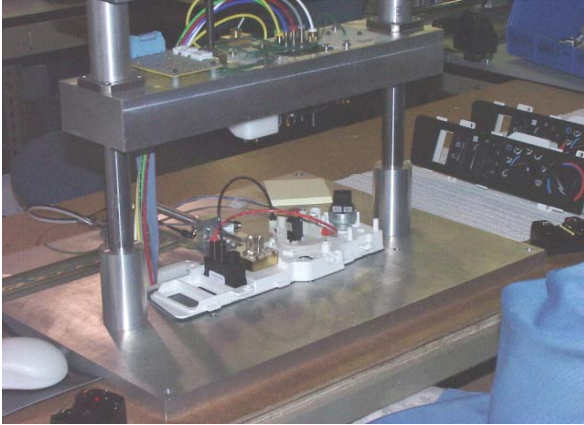
2. The holding clamp slides forward to hold control.



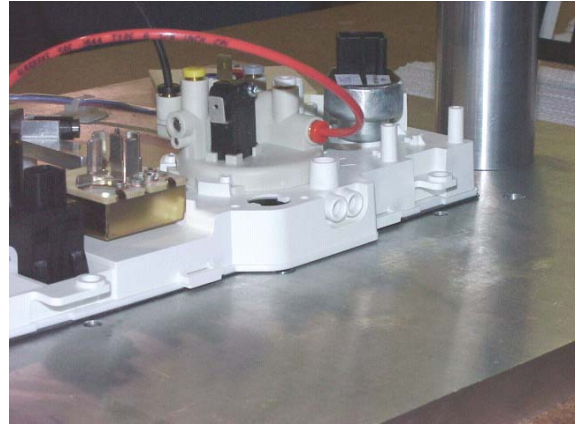
3. To start the test the operator must place hands in the



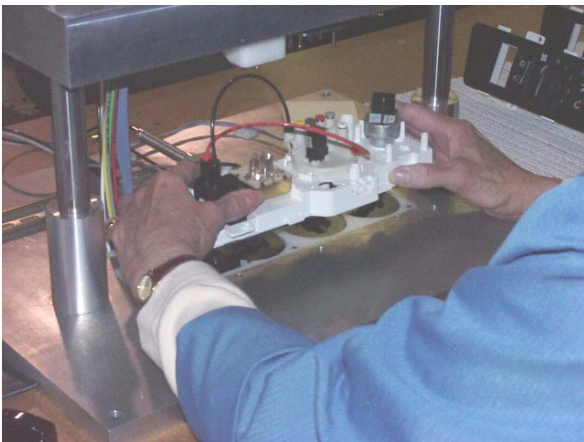
4. The probe block slides down to test the control



5. When the test is complete the probe slide retracts.



6. And the alignment pins retract.



7. The control may be taken out of the test fixture.



8. The computer gives a pass or fail message. If the control fails, a print out lists what the failure is.

### 3. Features of Design.

#### Concept

An automated test fixture that will test all aspects of the FLCC HVAC control to eliminate the hazardous hand motions involved with testing this product. This control has several operating aspects to it, mechanical, electrical and pneumatic functions that need to be tested. There are technical difficulties in automating this test. First the fixture must be able to probe all electrical contacts sufficiently to test accurately; second, the fixture must be able to probe and seal all pneumatic ports to test them. It must be able to retract far enough to allow plenty of access to insert and remove the control. It must also index the control through each mode, temperature, and fan control position to check functionality of the control.



## Implementation

All of the required features have been implemented in the test fixture. There have been some additional features that are designed to eliminate human error. There is a sensor to tell if there is a control in the fixture. Another pair of sensors check the number of cutouts in the decal to help identify if the correct part number is in the fixture. There are several different variations of this control, some of them have mechanical temperature control and others use a potentiometer. This test fixture has to be able to test all versions of this control, so the need for easy switch over was necessary. The probe blocks have been made so that they are easily removable to accommodate this need. (figure 2) This also makes it easy to upgrade this fixture if the control changes in the future.

Figure 1 shows the whole fixture in the ready to test state. Figure 2 shows the slide block with all of the probe blocks installed. Figure 3 shows the nest with the alignment pins rotator cups, “control in place” sensor, retainer clamp, etc.

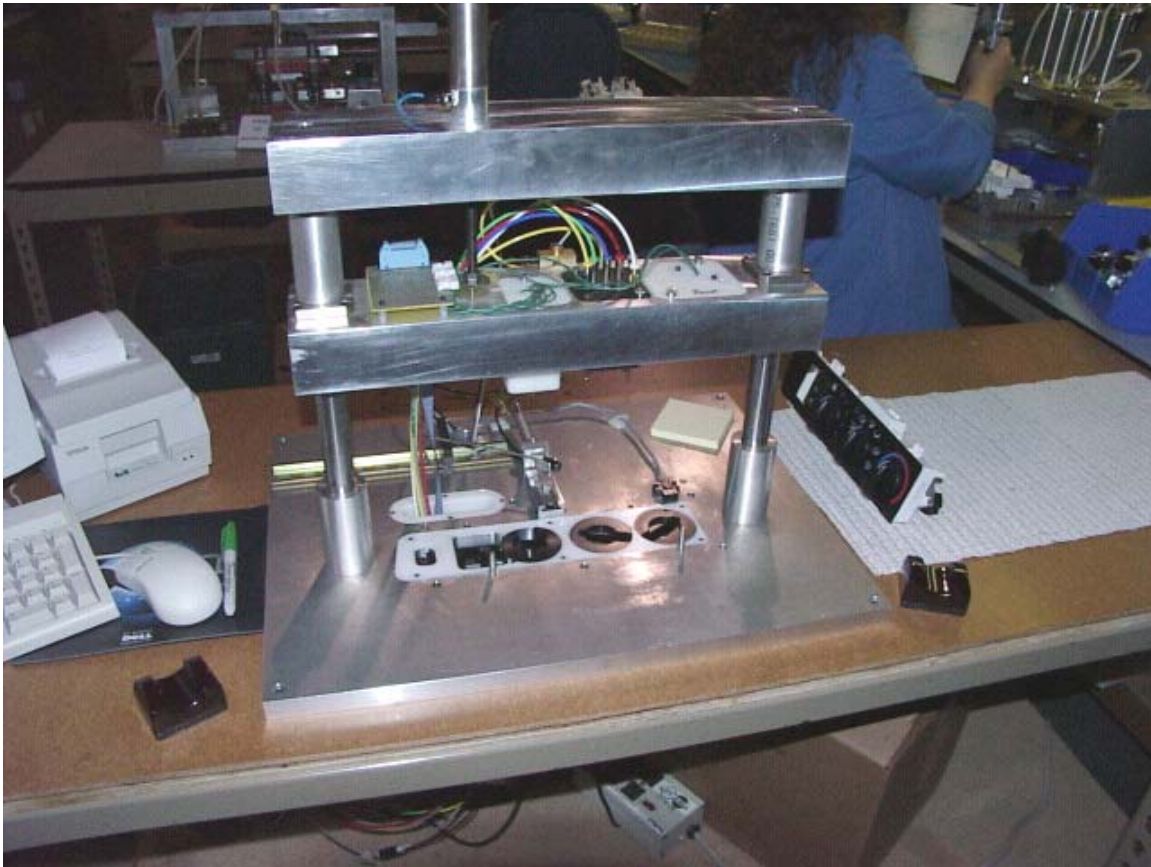


Figure 1

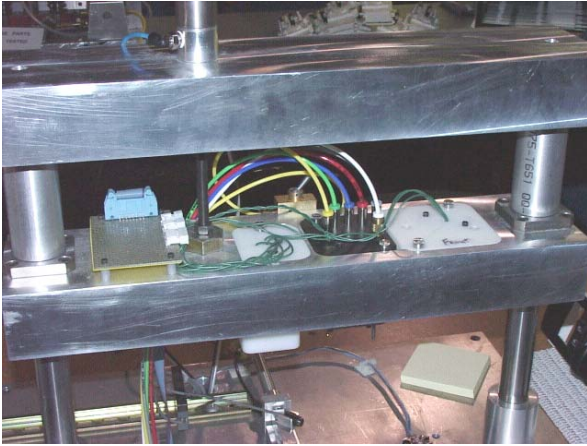


Figure 2



Figure 3

#### 4. Ergonomic Evaluation.

**Tasks for old process:** To test the HVAC control there are two electrical connections that must be plugged in by hand\* (two push pull operations) then the pneumatic probe block must be plugged in by hand\* (one push pull operation). Once this is completed the fan switch is turned by hand\* (one rotating motion) and the test panel is watched to see that the fan switch works in each position. Next the mode control is turned by hand\* (one rotating motion) while the operator watches the control panel to see if each position is functioning correctly. Then the temperature control is turned by hand\* (one rotating motion) to see if it has full travel. The rocker switch is flipped by hand\* (one pressing motion) to check the functionality of the switch. Time to test- 58 seconds (\*Ergonomic risk)

**Tasks for new process:** The HVAC control head is placed in the fixture by aligning the two lower mounting holes on the alignment pins. The position lock will then move into place and the test can be started. To start the test the operator must activate the fixture by placing their fingers in the optical switch. The machine then proceeds automatically. When the test is completed the HVAC control head can be removed from the fixture. When the fixture has reset itself for start, another control can be tested. Time to test- 54.5 seconds. There are no hazardous push pull motions, pressing motions or rotational motions in the new process.

The following evaluation comes from information gleaned from production personnel, ergonomics consultant, and our advisory group. A checklist of functionality needs for testing the control and the elimination of ergonomic risks is shown below.



of this and gives a message that every thing is good, or what is wrong with the control so that it can be repaired.

### **Cost Effectiveness**

Our goal with this project was to eliminate the ergonomic hazards to our production personnel and the associated medical costs for treatment of injuries due to these hazards. The one catch was that we could not slow our production down.

With the elimination of 95 percent of the hazardous motions from this station we have lowered our potential costs drastically. We have also noticed a reduction of the testing time for this product that has increased our production rate slightly, and has resulted in a savings of approximately \$150 annually.

### **Project Evaluation**

Getting the project started is the hard part. If you have not been through the grant request process before it can seem a bit overwhelming. There is an abundance of help and insights available through the Oregon OSHA Worksite Redesign Program staff and other companies that have been through the process. Once we got through the request and approval process the project proceeded smoothly. The quarterly progress reports kept everyone up to date and helped to show any schedule troubles that may be coming up. Overall the project has been a great success, and we are looking forward to working with the Oregon OSHA Worksite Redesign Program again in the near future.

### **Project Summary**

This project was needed to help eliminate an ergonomic problem that has existed for our production employees for a long time. Our goal was to eliminate ninety percent of the hazardous hand and wrist motions from the task of testing our FLCC HVAC control. The fixture that was designed and fabricated has done even better than that. We have eliminated ninety-five percent of the hand motions from the test process. The only hand motions that are left are the installation and removal of the control in the test fixture. The fixture turns all of the knobs, flips the switch, tests all of the pneumatic, electrical and mechanical aspects of the control. It also tells the test personnel if the correct part is in the fixture, if the part is good, and if it is not, it tells them what is wrong so that it can be repaired.

Our production personnel really enjoy having the new fixture to test this control. When asked during the Ergonomic Evaluation to give the fixture a grade it was a unanimous A+. We have gained improved moral, reduced possibilities of injury, less time lost due to injury, and a slight cost savings from a reduced test time. Overall this project has been a great success, and we are looking forward to working with Oregon OSHA in the future.