Background

Surface-mount technology (SMT) is a commonly used process in electronics manufacturing to apply electronic components on to circuit boards. During the process, solder paste is dispensed onto solder pads (where leads from the electronic component contacts the circuit board), and components are placed onto the boards in the pick-and-place machine. Upon exiting from the pick-and-place machine, the board is put through a reflow oven, where the solder paste melts, creating a conductive bond between the components and circuit board.

Many SMT processes apply an inspection process between the pick-and-place machine and reflow oven, since it is the last opportunity to make adjustments with little effort. This is the pre-reflow inspection system (process) (PRIS). After going through the reflow oven, adjustments would require manually melting the solder with a solder iron and re-applying solder from a spool – a slow and delicate process. Although there are machines capable of detecting errors, they require effort to program, are often prone to errors due to tolerance, and are unable to make physical adjustments.

Need

A electronics manufacturer wishes to add a PRIS process to their current SMT line. Their boards are complex – often composed of thousands of components, and the smallest components are 0402 (0.4 x 0.2mm). Unlike lines that produce large batches where the inspectors inspect the first board and sample later ones (since most errors would be caught in the first board, fixed, and production continues), this line produces prototypes, so most of the boards manufactured here are unique and require special attention.

The following information should be taken into consideration.

- Inspectors are to perform inspection tasks at the workstation for ~4 hours at a time, sometimes up to 8 hours.
- Other people such as engineers and technicians will often use the station as well, for short periods of time.
- The circuit boards arriving at the station have components that are held in place only with the viscosity of uncured solder paste.
- Larger boards are prone to flexing, even with special-designed braces that support the edges. Flex the board enough and it will fall through the conveyor.
- Inspectors will do more than just inspect boards. They will also make adjustments, mount additional components, program and monitor the reflow oven, organize paperwork, and access and refer to electronic schematics.
- There are no specific population demographics for the inspectors, so do design for a wide range of inspectors.
- There are several types of possible flaws: rotated components, reversed components, tilted components, missing components, solder blobs, and others.
Customer Requirements

Following are the customer's requirements for the PRIS.

1. The PRIS shall accommodate inspectors of *various* sizes.
2. All tools, equipment, and documents in the PRIS shall be *easily* accessible by the inspector.
3. The PRIS shall provide means for the inspector to accomplish *all tasks required to prepare boards and run them through the reflow oven*.
4. The PRIS shall be contained in a space not to exceed 10' x 8'.
5. The PRIS shall include all tools and equipment needed for *PRIS processes*.
6. The PRIS shall be *safe* for the inspector.
7. The PRIS should be *comfortable* for the inspector.
8. Implementation costs for the PRIS shall not exceed $5,000.