ClearPictures, Inc.[1]

By Jérémie Gallien[2]

You have just been assigned to respond to a consulting engagement RFP made by ClearPictures, a manufacturer of high-end professional digital cameras. As Jim Seethru, its VP of Manufacturing, gives you a tour of the production facility during your first visit to their plant, you find yourself trying to understand and memorize the main steps of the production process.

ClearPictures' product line comprises many camera models, but they are all basically assembled from two final components: a first subassembly containing the camera box and its lens system, and a second subassembly containing the digital picture sensor and its associated circuit board. Over the past couple of years, ClearPictures has strived to increase the commonality of its components by standardizing these two subassemblies, so that most of its camera models are now obtained from combining a limited number of boxes and sensor boards. ClearPictures outsources these two subassemblies from a few selected suppliers. Because their leadtimes range between 3 and 6 weeks, ClearPictures typically maintains a relatively comfortable inventory of boxes and sensor boards - ClearPictures seems to have been hit by component shortfalls in the past though, as emphasized by the grim on Jim's face when he mentions supplier leadtimes.

The first step in ClearPictures' plant is thus to mechanically assemble the sensor board with the box. Performed in a single assembly station, this turns out to be a relatively delicate step, because the sensor plane needs to be made perfectly perpendicular to the rays of light coming through the box's lens system, so that a very accurate geometric adjustment is necessary. As a result, this operation takes between 5 and 15 minutes, with most assemblies requiring about 10 minutes.

The second step is a sensor test and aims among other things at locating the dead pixels and columns on the sensor area (every sensor has a few of these) through a set of optical stimulations. The testing equipment then generates a map of the sensor's dead spots which is used by a camera-specific software downloaded then onto the circuit board' ROM (firmware); The purpose of this firmware is to automatically correct the pictures taken with the camera through a pixel proxy algorithm (weighted average of the digital color values of nearest functional pixels are used as a proxy for the dead spots). There are two such sensor testing stations at ClearPictures (ST1 and ST2), and you learn from Jim that the total setup, testing, firmware generation and download process for each camera requires between 13 and 24 minutes on ST1, and between 15 and 25 minutes on ST2. As you walk by this area, Jim (originally trained as an industrial

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engineer) makes the following comment about the sensor testing step: "I really can only give you minimum and maximum times here: it seems like the variability of process time with ST1 and ST2 is inherent to this type of process; a couple of months back, we assigned a college intern the task of performing a detailed SPC study on this process time, and his results turned out to be all over the place! One of the things we'd like to find out is whether we could perhaps reduce the overall negative impact of this step by purchasing a third machine".

The final step is Inspection, which comprises a range of numeric definition, focus, color and contrast tests performed on one camera at a time, in a single dark room designed to reproduce as closely as possible the actual consumer field usage environment. Jim comments: "because we're in the professional segment, this last step is key to the overall quality of our products. Our final tests are very demanding, this is apparent to our customers, and that's really where our competitive edge lies. As a matter of fact only 85% of the cameras make it through this last step without rework, while 15% are sent back to ST1 for a 10-15 minute firmware adjustment. In order to minimize the cycle time of cameras that require this rework, they get higher priority in the queue of work for ST1 though." When glancing over the time sheets lying on the final inspection working desk, you see that the total setup + testing time through final inspection seems to roughly follow a normal law with a mean of 9.5 minutes and standard deviation of 4 minutes. Finally, the remaining delay through packaging, shipping and transportation to the distributors' sites is about 6 hours.

During the remainder of the day, you find out that one of the main reasons why Jim has obtained the budget to hire some outside help (you) is that he is contemplating a switch from a push production mode to an assemble-to-order system where Box/Sensor Assembly and all subsequent operations would only be triggered by actual customer orders. When "selling" this proposal to the CFO, Jim argued that this could both allow a reduction in inventory costs and an improvement of the order fill rates to the distributors, two performance measures for which ClearPictures drags significantly behind benchmarked industry standards. However, because the production has always been organized in a make-to-stock mode using an ERP system so far, many at ClearPictures are worried about the consequences that the envisioned change could have on the relationships with distributors. Other options have been considered, such as expanding the current production schedule from a single 8 hour shift 5 days a week to perhaps 2 shifts and/or week-end production, but the extreme scarcity of qualified technicians able to operate such sophisticated machines appeared to be a serious constraint. As he leaves you on his way to an engineering meeting, Jim offers the following conclusion to your visit: "There's a lot at stake with this project, because despite the superior quality of our products we sense that delivery leadtimes are really starting to drive market share at this point. After a period of strong growth, our demand trend seems to have stabilized to about 40 orders per day now. Even if we still see a lot of variability in these orders, the timing may thus be right. Because of your experience and MIT training, we are very hopeful that you can help us succeed!".

Case Assignment Questions for ClearPictures, Inc.

1. Define precise and quantifiable objectives for the initial pre-implementation study which you would include in your consulting proposal.

2. Define (on paper) the simulation model you would implement in order to address the questions listed in your answer to Question 1 above. In particular, clearly state all assumptions and draw a process flow diagram.

3. From your answer to Question 1, choose the most important question to be addressed. Implement the model you designed in Question 2 on a computer, then design and perform a simulation experiment to answer that question. Provide a justification for your experimental design, then state the quantitative results from your simulation using 95% confidence intervals, and finally comment on your results.