FabTime Cycle Time Management Newsletter

Information

Mission: To discuss issues relating to proactive wafer fab cycle time management

Publisher: FabTime Inc. FabTime sells cycle time management software for wafer fab managers. FabTime's mission is to help the people who run fabs improve performance by: 1) letting them configure their own charts, so that they don't need assistance from IT for each new data request; and 2) including them in a community of people around the world who are all working to improve fab operations.

Editor: Jennifer Robinson

Contributors: Eric Tan (Qualcomm), Lucas de Bruin (NXP), Dave Kayton (ON Semiconductor)

Keywords: Bottlenecks; Industry Cycles; OEE; Forecast Arrivals; Case Studies

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Welcome

Welcome to Volume 21, Number 2 of the FabTime Cycle Time Management Newsletter. It's a changed world since we sent out the last issue in early February. Today, as we prepare to send this issue, the coronavirus is threatening millions of people across countries worldwide. Many people are hunkered down and working from home. Even when people are working in the office, companies are reducing the number of meetings and people are maintaining as much physical distance as they can.

This is all for a greater goal, of course, but it's also important that we as an industry continue learning from and connecting with one another. We hope that in a small way this newsletter can help with that. In this issue we share community announcements (some regarding COVID-19 resources) as well as tips for using FabTime's software remotely. We also have subscriber contributions and questions from colleagues around the world. Please consider responding. We are stronger together.

In our main article, we highlight examples from recent news stories that illustrate flexible thinking by companies and government agencies as they respond to COVID-19 shortages and shutdowns. As a company focused on performance improvement, we find these examples encouraging.

Stay safe, everyone! – Jennifer, Frank, Lara, and the FabTime Team

FabTime

Community News/Announcements

FabTime Promotes Lara Nichols to Vice President of Engineering

Frank and Jennifer are pleased to announce Lara's promotion to Vice President of Engineering for FabTime. As VP of Engineering, Lara's responsibilities will include:

■ Hiring the engineering team we need to support our customers.

■ Building internal processes to support productivity and minimize non-value-added activities.

■ Mentoring engineers as they expand their skillsets and shoulder new responsibilities.

■ Managing new-site installations and ongoing customer support.

■ Guiding core product development to attract new customers and satisfy existing customers.

Lara has been an employee of FabTime since 2007. In that time, she has served as Software Developer, Senior Software Developer, and Director of Engineering.

Jennifer and Frank have full faith that Lara will apply her considerable talents to achieve success as FabTime's Vice President of Engineering.

Past FabTime Newsletters

We're pleased to report that past issues of the newsletter are now available in PDF for download by newsletter subscribers from FabTime's website. The current password is "FabTimeCommunity" (no quotes, case-sensitive). You can download either a ZIP file containing all the issues or individual PDF files.

SEMI Coronavirus Resources

SEMI has been on the job helping members to navigate the COVID-19 situation and surveying companies to track responses. See this website for details. Resources offered by SEMI have included:

■ A joint-webinar with McKinsey and Company – COVID-19 Insights: Microelectronics Industry Impact and Best Practices.

■ Updates on cancellations and postponements of industry conferences and trade shows.

■ Best practices for company policies, communications and working from home.

■ A reminder of the key role that semiconductor companies have played and will play in the fight against COVID-19.

See especially this page, which SEMI is updating regularly with information about how the industry is responding to the crisis. The "FOA Responds" section is especially useful to the newsletter audience.

We also received word by email that the Q2 SEMI Fab Owners Alliance meeting, previously scheduled for May at SkyWater Technology Foundry, has been postponed.

Building Community on LinkedIn

Jennifer continues to share articles about business management, the semiconductor industry, and productivity improvement on her LinkedIn feed. Recent posts have tended towards topics related to the coronavirus, of course, though not exclusively. Posts worth noting here include:

■ An opinion piece shared in the Wall Street Journal suggesting that coronavirus quarantines will permanently change the way people work. Jennifer speculated: "Once people get set up and accustomed to doing work from home, there will be a permanent increase in remote work. This will not be true for everyone, of course (including people who work in manufacturing facilities), but for many." A number of people shared thoughts in the comments on the post.

■ The announcement of an auction to buy SK Hynix's wafer fab in Eugene,

Oregon, with bidding opening at $1.5M. The auction is now closed. We are waiting to see if an outcome is announced.

■ A number of posts highlighting manufacturing flexibility in the face of a global pandemic. These are discussed further in the main article below.

Connect with Jennifer here: http://www.linkedin.com/in/jenniferrobinsonfabtime

Note also that LinkedIn is providing daily coronavirus updates, with emphasis on business responses and impacts. See here: https://www.linkedin.com/news/daily-rundown/special-edition.

WinterSim Paper Deadline Extended

We noticed this announcement on the Winter Simulation Conference website and thought that subscribers might find it useful:

"Statement on COVID-19 for the WSC Community

We are in the midst of a public health situation unprecedented in our lifetimes and understand that all lives are currently impacted in one way or another by COVID-19.

Despite the fact that our annual conference is still months away, we are approaching the original paper submission deadline of April 3rd and therefore would like to address our community. We will continue to monitor the developing situation, hope that the current protective measures indeed "flatten the curve," and are maintaining our current plan of hosting The 2020 Winter Simulation Conference in December 2020, even if we need to get creative with our approach. Regardless of how we handle the conference, we want to assure everyone that there will be a forum for contributors to share their work, participants to learn and network, and sponsors to showcase their services and products.

In light of the significant changes in many peoples' lives, we have extended the submission deadline to April 24 and we encourage authors to continue to submit papers to this new deadline. The health and welfare of the WSC community is our top priority and we want to assure you that your conference management team is following the latest developments of the virus and we will continue to update you throughout the next few months to keep the community apprised of any adjustments that might need to be made."

More details are here.

FabTime welcomes the opportunity to publish community announcements, including conference notices and calls for papers. Send them to newsletter@FabTime.com.

FabTime User Tip of the Month

Use FabTime to Support Working Remotely

If you're like many people these days, you are working from home, helping to keep your company afloat while serving customers. It is our understanding that while most fabs are still operating, many individuals in support roles are working from home. We thought it would be useful to share a few reminders about using FabTime's software remotely. Obviously, any remote access to data in FabTime should be subject to your company's restrictions and policies.

If you are set up for secure remote access to your company's network, you should be

able to use a web browser to log in to your regular FabTime account. If so, you'll have full access to FabTime's capabilities. You can view home page charts, generate new charts from the Charts list, drill-down via data tables for more detail, and so on.

Even if you are not able to log into FabTime from home, you may be able to configure and use FabTime's alerts. All alerts that you create are sent to whatever email address you have set up in your FabTime account. You might have access to your corporate email without having full access to the network. You could set up alerts when you are on site and continue to receive them via email when working from home. If acceptable to your company, you could even modify the email address at which you receive alerts to be one that arrives as a text message to your cell phone. You can do this for all alerts by changing the email address in your FabTime account. Alternatively, you can selectively add the new address to the additional email address field within individual alerts.

Whether you are logged directly into FabTime or just getting information via alerts, you should be able to monitor areas of interest. You can then reach out to people working inside the fab via email or phone as needed. Of course, we always advise caution when sharing fab data across email systems, but we trust that your IT department is on top of data security in that regard.

If you are maintaining distance, you may find that sharing FabTime charts is useful. Remember that you can usually right-click on a chart to copy it as an image, which you can then paste into an email message. You may, depending on your browser, need to click the "D" button in the lower left-hand corner of the chart to make it static instead of dynamic first. You can also export data tables to Excel and share those. FabTime also recommends the app SnagIt, from TechSmith. You can use SnagIt to copy charts and/or data tables

and then annotate them for sharing. An example from FabTime's demo server is shown in Figure 1, on the next page.

Here are a couple of other thoughts regarding remote access:

■ If you have new FabTime users who are working remotely and not able to go into the fab, consider recommending that they go through FabTime's training videos. Improving one's skillset is always a good use of extra time. Depending on which version of FabTime is installed at your site, click either the Webinars or Videos link in the red FabTime toolbar. The Webinars link has archived versions of several of FabTime's online training webinars. The Videos link provides access to a more extensive collection of training videos.

■ There is a functionality in FabTime for setting up limited access user accounts. You could, for example, set up a FabTime account for a customer in which all charts are pre-populated with a filter that allows them to only see their own data. You can also limit which charts can be accessed via these accounts. If you are interested in learning more about this feature, contact your internal FabTime support person, or reach out to support@FabTime.com

If you are working remotely and have difficulty accessing any of your FabTime charts, remember that FabTime's team is also working remotely. Please reach out to us if there are changes that you need to make in your charts or accounts.

These are challenging times for people everywhere. It is our hope that this tip will help those of you who are working remotely to stay productive. We hope you find this useful.

If you have questions about this item, or any other FabTime software questions, just use the Feedback form inside FabTime's software. Subscribe to the separate Tip of the Month email list (with additional discussion for customers only). Thanks!
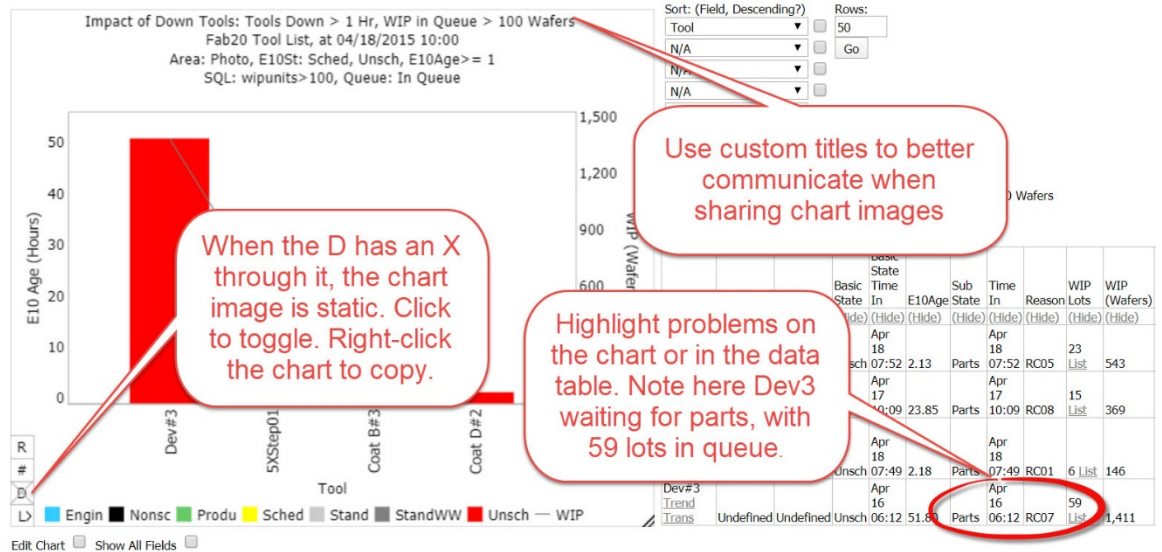
Figure 1. Example of a SnagIt Screen Snapshot from FabTime, with Annotations

Subscriber Discussion Forum

Case Study: Reducing Cycle Time with FabTime Data

FabTime is pleased to share a brief case study from **Eric Tan** describing how **Qualcomm's Singapore facility** has been using FabTime to drive cycle time improvements.

Eric wrote: "Implementing FabTime was complex for our site because the site does both front end of the line (FEOL) and back end of the line (BEOL) processing. MES framework changes were needed to be able to provide the correct data to FabTime to monitor the WIP separately for these two areas. Since this situation has been resolved, however, our production managers have been able to use FabTime's WIP charts, moves charts, and hold charts to review and monitor the line. The top management is also using FabTime to review results.

I am very pleased with FabTime's ability to give us a cycle time pareto so that we can focus our efforts to reduce cycle time. After making the MES changes in April of 2019 for the FEOL, our managers were able to reduce average weekly cycle time by around 10% (April to Aug 20) and 95th percentile cycle time by also around 10% over a period of four months. Some unrelated issues drove up cycle time temporarily after that. However, the team was able to use FabTime's reports to help recover from the problem and continue to achieve good cycle times.

After making similar MES changes in January 2020 for the BEOL, we have also seen good results in cycle time improvement.

Overall, what we see is that with the correct framework structure, FabTime can really help us with WIP management and reducing cycle time. We expect to see further improvement as we have more people using FabTime."

Demand OEE

Dave Kayton from ON Semiconductor wrote to us to propose a modification of OEE that accounts differently for time when a tool is starved. Dave wrote: As we all know, there is nothing wrong with idle time on a non-bottleneck tool, and there's nothing wrong with a low OEE on a tool that doesn't need to be run all the time. As long as a low-utilized tool has good availability and good rate efficiency, you will expect some operational efficiency loss.

To determine if a tool is capable of running at its modeled best OEE, we need a way to factor out the time the tool is idle because there is no work available, and we are measuring that using a metric we call **Demand OEE**. The simplest way to view this metric is just to subtract the hours that the tool is idle with no work from the denominator of the equation. For example, if a tool is productive for 42 hours in a week with no rate efficiency loss, it will have an OEE of 25%. However, if the tool sat idle with no work for 84 hours during the week, we would say the demand OEE was 50%.

Here's a concrete example. Suppose you have a tool with:

■ Productive = 40%

■ Standby no WIP = 30% (tool is starved)

■ Standby w/WIP = 20%

■ Downtime = 10%

■ Rate loss = 7%

The rate loss of 7% is seven percentage points of the 100% of available time, so we have:

Rate Efficiency = (1-Rate Loss)/Productive Time = 82.5%

Availability Efficiency = 1 – Downtime = 90%.

Operational Efficiency = Productive % / Availability Efficiency = 40%/90% = 44.44%

Performance Efficiency = Rate Efficiency * Operational Efficiency = 82.5% * 44.44%

OEE = Availability Efficiency * Performance Efficiency = 33%.

Does this reflect the true performance of the tool? Not really, because we are essentially penalizing operators for not running the tool when there was no WIP to run. Should we adjust OEE for the time when the tool is starved? I propose this adjustment:

OEE(Demand) = OEE / (100% - StandbyNoWIP %)

In this example, OEE(Demand) = 33% / (100% - 30%) = 47%"

FabTime Response: What do other subscribers think? Is this a useful modification to OEE, to better include non-bottlenecks?

Predicting Cycle Time Bottlenecks

Lucas de Bruin (NXP) wrote: "Currently, I am doing research about predicting bottlenecks. I saw in the last newsletter from FabTime that you choose bottlenecks with the highest amount of lot wait time.

1. Do you think that you can also predict bottlenecks based on lot wait time? (Predicting for the next 24/48 hours)

2. What kind of variables would you use here? I thought, for example, of WIP and down tools."

FabTime Response: This is an interesting question. In our software, we do predict where WIP will be in the future. Users can generate a list of what lots the system thinks will be in queue for a particular tool group (or operation) during some future time window. Since we know

what operation the lots will be in queue for at that point, we could certainly sum up that wait time and thus predict bottlenecks.

The limitation in this case is that the data we use to predict where lots will be is the planned cycle time by step. We project each lot forward based on that planned cycle time to generate the data. This is straightforward to do, provided the customer has that planned cycle time data (which could be based on a target x-factor or on historical averages). However, this method doesn't consider dynamic data like current WIP levels (e.g. you can't possibly achieve the planned cycle time at that step because the WIP levels are so high right now) or tool downtimes.

You could attempt to use that more dynamic data, but for that you would probably need to use some sort of simulation. That gets tricky, because of course you don't know what's going to happen with tool uptime in the future. It might be possible to use queueing models to do something in between (use some dynamic data, like the WIP levels, without going to a full simulation), but it would be challenging.

Do any other subscribers have thoughts on predicting cycle time bottlenecks?

FabTime welcomes the opportunity to publish subscriber discussion questions and responses. Simply send your contributions to Jennifer.Robinson@FabTime.com.

Demonstrations of Manufacturing Flexibility

Introduction

This has been a challenging time for companies around the world. Hospitals are either already overwhelmed with coronarvirus patients or preparing to be inundated. Everything from ICU beds to ventilators to masks is in short supply. Efforts to "flatten the curve" of COVID-19 infections have led to unprecedented shelter in place orders. While these restrictions do appear to be having the desired effect, entire industries are being decimated by drastically reduced business.

Events are shifting too rapidly to get into any detail here. However, we have been encouraged by examples of flexible thinking from companies and local government agencies. Companies are demonstrating manufacturing flexibility, ramping up production and shifting to new products. Other companies and agencies are showing logistical creativity, finding ways to repurpose underused resources. Through these activities, important deficits in health care capacity are being addressed. Also important: these activities are helping to keep people working, which dampens the enormous economic impact.

These examples of flexibility and ingenuity give us hope. In this article, we share a few of the multitude of examples. We hope that they inspire you as they have been inspiring us.

Of course, there are other sources of inspiration out there, from individuals making personal sacrifices to companies and individuals making generous donations. But we suspect that our newsletter community shares with us a fascination with efforts on the manufacturing and logistical side.

Demonstrations of Manufacturing Flexibility

Every day we see new stories about companies ramping up production and/or making changes to what products they make in their factories. For example:

■ Hanes is retrofitting manufacturing facilities to produce masks for health care workers (following specifications provided by the FDA) (ABC News). So is Gap (Business Insider).

■ Numerous companies, from perfume makers to distillers have shifted operations to start making hand sanitizer (WSJ and San Jose Mercury News). Other companies are making efforts to retool their existing production lines to increase capacity (WSJ). One company has a plan to build a new hand sanitizer plant in 10 days, with a goal of making 1 million bottles a month. (INEOS Group).

■ 3M is working to expand production of N95 masks, planning to double production capacity over the next 12 months (Forbes).

■ Dyson, a British technology company known for making hair dryers and vacuums, developed a new ventilator design in 10 days, and is working to get it approved and into production as quickly as possible (The Verge).

■ Car manufacturers worldwide are at least looking into retooling to make medical equipment, especially ventilators, while other device companies are increasing production (WSJ). Fiat Chrysler said, as reported in TechCrunch, that "it will start manufacturing face masks in the coming weeks and donate the critical medical equipment to first responders and healthcare workers". Ford is working with 3M and GE to make respirators and ventilators (CNN).

■ Food producers are changing to smaller packaging to provide portions for stores instead of restaurants (WSJ).

■ And yes, toilet paper manufacturers are increasing production to combat shortages (whether those are rational or not). See this recent Idaho Statesman article, among many, which notes that TP manufacturing has been deemed "essential."

Other Displays of Adaptability and Use of Resources

■ Governments are using empty hotels to house and protect the homeless and provide space for health care workers. In just one example, the San Jose Mercury News reported: "San Francisco supervisors are working on making as many as 8,500 hotel rooms available this week to homeless residents, healthcare workers and first-responders who have nowhere to isolate during the coronavirus pandemic." We also read about hotels offering quarantine packages to fill their empty rooms and give people with possible or mild cases somewhere to go.

■ Airlines have started using empty passenger jets to move cargo (WSJ).

■ A restaurant in Los Gatos, CA transformed itself into a drive-through grocery store, finding a way to feed people, use up unneeded food stores, and keep employees working (Mercury News).

■ Hertz is offering free rental vehicles to health care workers. This makes sense, given the large number of rental cars that are sitting idle right now (WSJ).

■ 2000 emergency medical workers in San Francisco will wear smart rings that measure their temperatures, in the hope of detecting coronavirus early. This is a novel use of a new technology (Business Insider).

■ Intel donated one million protective items that it had on hand (because workers wear these items in the fabs, of course) to health authorities in California, Washington State, Arizona and Nevada. This is a timely reallocation of resources that Intel staff would have eventually used themselves (Portland Business Journal).

■ ON Semiconductor donated 10,000 face masks ([Phoenix Business Journal](#)) for health care workers and first responders in Phoenix.

■ [The Mercury News reported](#) that an employee at the San Jose Police Department remembered some face masks in storage and searched until she found 50,000 masks. The department didn't urgently need them and donated them to local hospitals (one of those hospitals the one that Jennifer's husband works at, to her personal gratitude).

Three Other IE-Related Observations

Lean Manufacturing: Grocery stores have struggled mightily to respond to the quarantine-driven surge in demand. A [Wall Street Journal article](#) noted that "In the past two decades, producers and grocery stores such as Kroger Co. have gone from keeping months of inventory on hand to holding only a four to six weeks' supply." This was a conscious choice: run more efficiently by holding less safety stock. Now retailers are seeing the downside of lean manufacturing: less flexibility.

Roadway Utilization: As of March 25th, the Bay Area had seen the largest drop in traffic of anywhere in the US. A silver lining to this was that supply trucks were getting through much more quickly to keep stores restocked with essential goods. This is queueing theory 101, of course: lower utilization (of the roads) leads to lower cycle times (for drivers) ([Mercury News](#)). A [second article](#) noted that if increases in remote work after the crisis were to lead to even a 3% reduction from previous traffic levels, this would be accompanied by a significant decrease in congestion on the worst roadways. This, as regular readers of the newsletter will understand, is because that 3% reduction would move us away from the steepest part of the cycle time vs. utilization curve.

Internet Capacity: Internet access has been essential these past few weeks, as more people are working and/or learning from home. A [recent Wall Street Journal article](#) noted reported this increased usage hasn't "broken" the internet because so much of the increase has taken place during daytime hours, when residential usage was previously low. Because we're using previous idle capacity, our systems have been able to tolerate the increase, thank goodness!

Conclusions

The examples provided here are in no way a comprehensive list. By the time you read this, they won't even be a current list. But we think that the sheer breadth of examples of flexible thinking is encouraging. This is a world-wide crisis. People from all sorts of backgrounds, from governments to manufacturers to health care workers, are meeting it with determination and creativity. Together, we will, as a world-wide community, get through COVID-19 and get normal life back on track.

Closing Questions for Newsletter Subscribers

What examples of capacity or resource re-allocation have you seen in your companies or read about in your news sources? Do you find that reading about such efforts helps in coping with the uncertainty that we're all facing?

Acknowledgements

The coverage in the Wall Street Journal on business flexibility has been extremely useful in all this. A number of these links were also shared by Jennifer's connections on LinkedIn, found through her local paper, the San Jose Mercury News, and found via the technology website The Verge. Of course, there are countless other examples to be found world-wide, but we hope that this sampling of stories has been useful to you.

Subscriber List

Top 20 subscribing companies:
- ON Semiconductor (217)
- Infineon Technologies (151)
- Intel Corporation (117)
- Micron Technology, Inc. (116)
- GlobalFoundries (105)
- Maxim Integrated Products, Inc. (87)
- NXP Semiconductors (81)
- Microchip Technology (71)
- Carsem M Sdn Bhd (70)
- Skyworks Solutions, Inc. (65)
- STMicroelectronics (65)
- Western Digital Corporation Inc. (64)
- Texas Instruments (55)
- Seagate Technology (52)
- X-FAB Inc. (49)
- Qualcomm (45)
- Analog Devices (42)
- Tower Semiconductor (34)
- Cree / Wolfspeed (32)
- Honeywell (31)
- Zymergen (31)

Top 4 subscribing universities:
- Ecole des Mines de Saint-Etienne (EMSE) (9)
- Arizona State University (8)
- Nanyang Technological University (7)
- Virginia Tech (6)

New companies and universities this month:
- Flexciton
- ISO Technology Sdn. Bhd.
- Oxford Instruments Plasma Technology
- Plessey Semiconductors
- WLP Concepts

Note: Inclusion in the subscriber profile for this newsletter indicates an interest, on the part of individual subscribers, in cycle time management. It does not imply any endorsement of FabTime or its products by any individual or his or her company.

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