My Coop Experience at Texas Instruments

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**Introduction:**

Texas Instruments Incorporated is the world leader in digital signal processing and analog technologies, the semiconductor engines of the Internet age. TI is a leader in the real-time technologies that help people communicate. It is moving fast to drive the Internet age forward with semiconductor solutions for large markets such as wireless and broadband access and for new emerging markets such as digital cameras and digital audio. TI envisions a world where every phone call, every Internet connection, every photograph taken and every song people listen to, are touched by the power of TI's Digital Signal Processor (DSP) and Analog technologies.

Now, lets take a look to the company’s historical background and its most famous inventions. The foundation took place in 1930 when it was called Geophysical service Inc. Their business was to help petroleum companies search for oil using seismic technology. Later with the arrival of World War II the business changed to defense electronic systems.

In 1951 the company became Texas Instruments and in 1952 began its business in the semiconductor industry. For more than six decades, Texas Instruments has created milestone innovations, including the first commercial silicon transistors, the first integrated circuit, and the first electronic hand-held calculator.

![Figure 1: First Integrated Circuit and Commercial Transistor Radio](image1.png)

The newest invention is the Digital Light Processing™ (DLP™) chip. This chip contains a Digital Micromirror Device™ (DMD™), an optical semiconductor chip that has an array of up to 1,310,000 hinged, microscopic mirrors which operate as optical switches to create a high resolution, full color image.

![Figure 2: DLP Chip](image2.png)

This new device has won several awards including one from the Academy Awards®. Another accomplishment is the reduction of transistor sizes to 0.15 microns.
The Company has approximately 34,700 employees worldwide including Asia, Japan, Europe and The Americas. The Dallas headquarters have over 10,000 employees. In Asia, TI has 10,500 employees. TI has been operating in the region since the 1950s, beginning with sales and marketing activities, then quickly adding semiconductor assembly and test facilities, and materials and controls manufacturing capabilities. Asia today is also home to some of our most advanced semiconductor wafer fabrication facilities. In addition to semiconductors and materials and controls, TI markets electronics systems and personal productivity tools, including calculators and electronic organizers. First established in Europe in 1956, TI currently operates in 14 European countries, with two manufacturing operations, an advanced wafer fabrication center and seven IC design centers. TI Europe has 3,000 employees and revenues in 2000 of $2.7 billion.

![Figure 3: World Wide Locations](image)

It is also good to say that TI counts with a great diversity of employees. Texas Instruments recognizes that a diverse, empowered workforce is a means for achieving a sustained competitive business advantage. Because of this belief, TI has taken great strides toward not only embracing diversity, but also weaving it throughout the fabric of the corporation. Each TI business group is responsible for developing and executing strategies that will promote diversity at all levels.

The major areas at TI are Semiconductors, Educational & Productivity, Sensors & Controls and DLP™ Products. In the semiconductor area the departments are Application Specific Products (ASP), Wireless Business Unit (WBU), High Performance Analog (HPA) and the High Volume Analog and Logic (HVA&L). Broadband Communications is part of the ASP area. Our team is a section of Broadband called AMS Codecs. Our
team is assigned to build multiple codecs for many cutting edge broadband applications our customers want. In the present our section has various products for applications including Central Office (CO) Cable Modem with Ethernet/ISDN capability, Voice-Over-IP, Digital Subscriber Line (xDSL) and home networking with a Power Line Codec. For more information on Codecs refer to the “Technical Background” section.

Figure 4: Applications of Broadband for Home Networking
Assignments:

One of the most important tasks of a product engineer is characterization. This is to analyze and understand the behavior of a device. This is important to see if the device is complying with the established specifications according to the market or specific customer needs. Yet, in the characterization process thousands of parameters are to be studied. To study these parameters the test engineer generates a test program and then devices are put under test in an Automated Test Equipment (ATE) and the data is collected. After this step we end up with data files that have to be organized to be understood. According to the principles of Statistical Process Control (SPC) (This will be discussed on the “Technical Background” section), we cannot make conclusions with a single device. For our conclusions to take validity we need to perform the tests to a representative sample of the population. So if we multiply two thousand tests by one hundred devices we get a very large matrix to look at. This makes the analysis very time consuming and tedious. Still we need to add that the tests are performed two more times to the devices, in high temperature 85°C and in low temperature -40°C.

For this reasons one of the first assignments I had was to create an automated spreadsheet that would make easier the data analysis. For this task I used Microsoft Excel. When the data is collected from the tester equipment it is stored in a format that is only understood by data analysis software called dataPOWER. So before starting with my task I had to understand this software, which I had never seen before. Then I managed to store the data in Excel format to begin with the creation of the spreadsheet. There are several reasons that made me take the decision of not using dataPOWER for the spreadsheet. First this program has many tools for wafer analysis that were not used for this document. This complexity makes dataPOWER to use up many resources in the system and its performance is much slower that Excel. Another reason is that Excel has a user-friendly interface. Also, we wanted to share this information with designers and other people that don’t have access or do not know how to use dataPOWER, but almost everybody has Excel and with very few knowledge can work through it. Yet, the most important reason is for the capability of boosting its performance with the use of visual programming with Visual Basic for Applications (VBA). Information on this software will be included later on.

This document needed to contain charts and tables of the data and many statistical calculations like average, standard deviation and Capability Index (Cpk). Doing this is not quite hard due to the great number of formulas and analysis tools already provided by Excel. The difficulty was to create it to be automated and be able to accept different data sizes. We have to remember that not every device is tested for the same amount of parameters or the same amount of devices. For these reasons I had to learn to build macros in Visual Basic for Applications, a programming language I had never work with before. I also had to learn to create graphic user interfaces (GUI) to make it easier to use. I will explain this document by presenting a screen shot from Excel.
The tables created contain information on how the data was distributed. It was separated by room temperature (25°C), high temperature (80°C) and low temperature (-40°C). This is the guaranteed operating range to the customer so that it is very important to test in those temperatures. I included a scattered chart that included all the data points. This way it is clearly seen how the device behavior changes with temperature and if a specific parameter is temperature dependant. The purple and light blue straight lines on the left chart represent the upper and lower specification limits, respectively. With these lines we see if our device is within our specs and depending on the standard deviation if we are going to have a significant yield loss in production. The other chart contains another set of data point to study the repeatability of our tester and our fabrication process. A cell contains the repeatability percentage and depending on the value a rating is given and the cell changes its background color as an indication.

The visual elements of the code were click buttons, message boxes, and list boxes. This screen shown looks for the data in different sheets. For this device there were nearly 2,500 tests so the click buttons help to go one by one through the tests. For easier scrolling a list box was included. This way the user could scroll down very fast until he found the desired test. When the buttons or the list box was selected a macro would run in the background. This would change the data displayed in the charts and tables. Another button was added labeled “Analyze”. This button had to be pressed the first time the user
was going to study a set of data. This will run a macro that would look for the data files in a specified location and would make them ready for analysis. In the background the references, tables and charts were created while the user just saw message boxes displaying the number of units tested or the number of tests performed to each test. After this the macro disabled the button and would ask the user to save the document in a new name so the original document would stay intact.

With the success and acceptance of the team members I was asked to make a second version of this document by including the distribution of the data points to see if they approximated a normal distribution. This time the data was collected at the same temperature but in different testers. For this reason a correlation coefficient was included to study if the data behaved the same way despite this different condition.

![Second Version of Data Analysis Tool](https://example.com/data.png)

The next logical assignment after creating a sheet to study the behavior of a device in different equipment is to understand the behavior of the parameters tested. I was asked to study tester-to-tester correlation for various parameters like Signal-to-Noise ratio (SNR), Total Harmonic Distortion (THD), Total Signal-to-Noise plus Distortion (TSNR) and Gain Error. These parameters are very important as they measure the performance of our device. SNR takes into account the noise, the THD the harmonics of the fundamental frequency that cause distortion and TSNR is the sum of both components. The Gain Error is a comparison of the actual gain vs. the expected or ideal gain.
This analysis is very important because the test equipment depends a lot on its calibration. Different testers have different calibrations so we need to make sure that in won’t matter which tester you use the device will still be inside the specification limits. Correlation measures how two variables are linearly related. So if the only effect of testing in a different tester or environment is an offset of the values then there is a great correlation. However, this is not always the case and we have to study it. For example, the test program is developed in Dallas and some testing is done there but the mass production is done in Taiwan. If there is no correlation then we cannot predict that the way a device behaves in Dallas is going to be similar to its behavior in Taiwan.

![Figure 7: Correlation Between Dallas and Taiwan Testers](image)

As we can see from *Fig. 7* we notice that the have a very similar behavior that is main difference is an offset from each other. When the correlation coefficient was calculated for this specific parameter the result was 0.999825, an almost perfect correlation.

The telecommunication standards vary in different regions. Our device has to be able to work according to the standards established in the place it is going to be used. These operation modes are Asia, Europe and Japan modes. We need to see of despite the signal level and other settings the device still performs in the same way.

![Figure 8: Performance in Different Operation Modes](image)
Considerations in Characterization:

There are other factors considered in characterization than just temperature change. The fabrication process in the semiconductor industry is susceptible to variations. After many years of study it have been seen that the parameters that most affect the device’s performance are the High Sheet resistance and the Threshold Voltage, HSR & Vt respectively. Sheet resistance is very important because any change in resistance will cause changes in input currents and voltages. This will cause that the performance of the device changes. Vt is very important too because it controls the point where transistors switch. This can be critical in data transmission applications were data can get corrupted by a 1 that should be 0 and vice versa.

To adequately analyze the effect of the variations special lots are built using different center values of these parameters. They are varied up to more or less fifteen percent of the nominal value established in the design process. Our devices have to be able to operate within the specifications after these variations. After shipping thousands of units to a customer, if they get returned our team will lose a lot of money for just a slight variation in our fabrication process. As a standard adapted the HSR is varied in nine different lots and the Vt is varied in seven different lots.

Our devices right now are operating at a power supply voltage of 3.3V. Still we have to guarantee to the customer that a variation in their power supply will not cause the device to fail. For this reason in the characterization process the power supply voltage is varied on purpose to two additional voltages, 3.0V and 3.6V. So data is collected at these 3 different operating voltages.

Now we see that the data collection process is one that requires a lot of time to be completed. After learning this I started seen the importance of the spreadsheets created to make easier the data analysis step.

Test Equipment:

After learning the importance of data analysis and how a device changes its performance with temperature and other factors I had the opportunity of going to the test floor and collect data for a device characterization. The test floor is located in the North Campus’s South Building (5 – 10 minutes by car from South Campus where I work). This place is commonly known as Characterization Laboratory (C-Lab). To be able to do this task I had to learn a couple of things before starting. I had to learn how to operate the tester and work with its interface computer. This system uses a Unix operating system so I had to learn some Unix basics too.
One of the testers used by the broadband team is Teradyne’s Catalyst. This tester is designed specially for mixed-signal applications. The program that the tester uses is called Image. This software is used to control the tester. In this program the test code is written, compiled and debugged. Image can also be run in a PC that is not connected to the tester to perform simulations and editing of the code. The black circular area we see in fig. 9 is where we connect our device, but a Device Interface Board (DIB) is needed so that the proper interfacing can be achieved. Every device tested is different and may need unique circuits so that the desired tests can take place. This is the purpose of the DIB and it consists mainly of relays. On top of the DIB there is a socket where the Device Under Test (DUT) is put. Now we can load devices one by one while running the code. While the testing takes place the data is stored in a file that will contain the data of all the units when you are finished testing.

When collecting data one of the mayor concern is all the time that it takes to realize this process. One of the devices that I have been working with takes about 37 seconds per unit to complete all the tests. If we test about 60 units per lot and have 15 different lots we can end up with almost 3,000 units that have to be tested. Remember, 9 lots for HSR, 7 for Vt times 3 temperatures times 3 operating voltages. This is very time consuming and not the mention the time it takes to pick a unit and put it back in the tray, placing the next one and then running the program again, and remember that we need to multiply this by 2 to take in account high and low temperature. Hopefully there is an easier way to do all this testing.

A great tool that helps us to reduce our time and discomfort of all this testing is a handler. This is an automated machine that contains some robotic “hands” and an internal chamber where the units are tested.
Fig. 10: Delta-Flex Pick & Place Handler

Fig. 10 shows the Delta-Flex Pick and Place handler. We put trays that can contain more 100 units, depending on the unit size, on the left side. Then the machine takes them inside, performs the tests and then puts them back in another tray on the right side using the other robotic hand. Another great advantage of handlers is for the high and low temp tests. A good number of devices are loaded inside the chamber where the handler acts as an oven or refrigerator. When the units reach the temperature established the testing begins. However, supervising of the handler is need because it can fail to pick a unit or even drop it and the testing routine will stop until the conflicting units are properly placed or removed.

After concluding this step the data was ready to be organized and then be analyzed. All the files were transferred, using File Transfer Protocol (FTP), from C-Lab back to my office in the South Campus. It was of great satisfaction to be able to use the analysis tool I created before to perform analysis on the data collected for these devices.

Post Characterization Review (PCR):

After the team analyzes the data many issues arise. This is why all the members of the team, Design, Product and Test engineers and all other people involved with the device like marketing people gather in a meeting, Post Characterization Review, to discuss these issues.

The Product Engineer (most of my assignments have been in this area) shows all the problems seen during characterization. In this way actions are taken to fix the problems or to improve the performance of the device. Sometimes it might be a problem in the test code or a design issue. Sometimes failing parameters make the yield go down, resulting in revenue loss because we cannot sell a unit that might fail in some areas.
We can clearly see in fig. 11, by the upper limit (blue line), that this D/A Converter will cause a great yield loss in production. The team may decide to speak with the costumer to negotiate the relaxation of this limit. After all the decisions are made the test limits have to be updated. I was asked to update this limits in the test program and to proceed with the verification of these new limits. For the verification process not all the units have to be retested.

Another issue discussed in the PCR is Bench-to-Tester correlation. Specific units are tested using bench equipment and then these same units are taken to the test floor to be tested again. This is very important to identify any problems in the test program or in the automated test equipment. The analysis is similar to the one discussed before for tester-to-tester correlation.

In fig. 12 we have an example of the way data is organized for the comparison between the bench and tester readings. In this example the unit labeled as #3 is being compared. If all the tests correlate there is more validity in the conclusions that are made since the readings were proved in these two different methods of testing.

A few paragraphs above we saw the importance of the device’s yield. I was also assigned to perform a yield analysis for Caesar, a Cable Telephony device, before the PCR took place. Yield analysis is important to know how severe is a problem. Some parameters that fail might cause a greater yield loss than others. Lets remember that a unit will be rejected from a lot even if just one parameter fails during production testing.
A special spreadsheet was created to look at the yields separated by lot and temperature and then averaged by temperature only. In this sheet yields lower than 95% were automatically marked in red to indicate that the yield in that case is not good. The profits we make out of a device depend on our yield. Each device has its own Cost-of-Build (COB) so we have to make sure that this cost is as low as possible. The more units we loose the less profit we will have.

<table>
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<tr>
<th>Test#</th>
<th>Parameter Name</th>
<th>LPL</th>
<th>UPL</th>
<th>HSR Yield Average</th>
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</thead>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>-40C</td>
</tr>
<tr>
<td>1671</td>
<td>post_VREFSLIC_value</td>
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<td>1.42</td>
<td>92.53%</td>
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<tr>
<td>1672</td>
<td>pre_RTRGMC_value</td>
<td>1.47</td>
<td>1.75</td>
<td>100.00%</td>
</tr>
<tr>
<td>1673</td>
<td>post_RTRGMC_value</td>
<td>1.58</td>
<td>1.63</td>
<td>83.40%</td>
</tr>
</tbody>
</table>

Figure 13: Section of Yield Analysis Sheet

I already informed about my tasks and assignments given to me in these past three and a half months. All these things were learned during the process so I am very satisfied with the knowledge acquired up to this point. My boss has already discussed with me some details of a task that is coming soon called Single Test Single Insertion (STSI).

STSI means to perform production testing at just one temperature. The purpose behind this is cost reduction. Every second of test time can cost up to 10 cents. Even more, the temperatures we intend to eliminate are room and high temperatures. First room temperature is the less problematic so it is quite easy to remove it. Yet, the elimination of low temperature testing can be quite a tricky. The fact the liquid nitrogen is constantly being pumped to the tester raises the cost of this process. Money would be saved by not needing to have a supply of this gas. Another great factor is the handler problems occur more often at low temperatures, -40 degrees is real cold. Parts are more likely to be drop. Doors and inside storage boats also get stuck more easily. The problem is that every time this occurs you cannot just open the storage compartment and fix the problem. As soon as you open the door ice particles melt and me turned on again the freeze and can break the handler and damage the units because of the moisture. The solution is to rise up the temperature to 100 degrees Celsius to assure that all the water has evaporated and all units are free from moisture and then start cooling the system again. This process of heating and cooling back can take more than thirty minutes an unacceptable lost of time. I expect to start working on this assignment in the next couple of weeks.
**Technical Background:**

**Statistical Process Control:**

Statistical Process Control (SPC) is a way of controlling processes by the use of statistics, where statistics can be viewed as a tool to gather information from a set of data. Quality control plays an important part in any manufacturing operation. TI uses statistical analysis as the basis for defect prevention. Statistical analysis provides the solid base on which to build programs to reduce variation, to maintain processes in tight control and to achieve continuous process improvement.

Our company uses SPC to be more competitive in certain ways. Our products will be of better quality. Another advantage is that operation costs and the waste are greatly reduced. Also our products will reach the customer’s hands faster than before because the process will have fewer errors.

Now I will present some of the terms and formulas of SPC used by my team.

Repeatability – The variation of a measurement system obtained by repeating measurements on the sample back-to-back using the same measurement conditions. Repeatability is measured by the standard deviation of the repeated measurements.

Reproducibility – The variation among the averages of the measurements made at different measurement conditions, e.g., different operators, different environments, different laboratories, etc.

Process Capability – The inherent variation of the system that refers to some unique combination of machine, tools, methods, materials, and people engaged in production. Process capability is defined as ±3σ from the average.

Capability Ratio ($C_p$) compares Process Capability to the Specification Limits.

\[
C_p = \frac{\text{Specification Allowable}}{\text{Process Capability}} = \frac{USL - LSL}{6\sigma}
\]

USL – Upper Specification Limit
LSL – Lower Specification Limit
Process Capability Index – Measures the process capability with respect to centering between specification limits.

\[ C_{pk} = \text{minimum} \{ C_{pu}, C_{pl} \}. \]

Where:

\[ C_{pu} = \frac{USL - \mu}{3\sigma} \quad \text{and} \quad C_{pl} = \frac{\mu - LSL}{3\sigma}. \]

Cp tells how well the process could do if centered, with current variability. Cpk tells how well the process is actually doing, with current centering and variability.

Standard Deviation – Unit of measurement that is utilized to describe the width or spread of a distribution or pattern.

Correlation – A correlation coefficient is a number between -1 and 1 that measures the degree to which two variables are linearly related. If there is perfect linear relationship with positive slope between the two variables, we have a correlation coefficient of 1; if there is positive correlation, whenever one variable has a high (low) value, so does the other.

Yield – Is an indication in percentage of how many samples are within a specification from the whole population.

**Product Engineer:**

A Product Engineer’s primary role is to support the production of the new device as it matures and proceeds to profitable volume production. The product engineer helps identify and correct process defects, design defects and tester hardware and software defects. For this reason the Product Engineer is considered as the device owner. Any problems that occur after the product has been released to production, including customer returns are responsibility of the Product Engineer. He is going to be the first person asked for answers when a problem or failure occurs.

Sometimes the product engineering function is combined with the test engineering function, forming a single test/product engineering position. The advantage of the combined job function is that the product engineer portion of the job can be performed with a much more thorough understanding of the device and test program details.
Visual Basic for Applications:

In 1994, Microsoft announced to the world that its goal was to make Visual Basic the macro language for all of its applications. Microsoft later incorporated customizes versions of VBA into all of its Office applications, starting with the Office 97 suite.

Just about any task performed manually in Excel can be automated using a macro coded in the VBA language. A good advantage is that macro can be recorded so that you don’t need to know the Visual Basic language. You can also use the record function to look at the code generated and learn from it. Any thing you learn in VBA will apply for all other Office applications that use this software.

AMS Codecs:

TLV320AIC22C – Dual Voice-Over-Internet Protocol (VOIP) Codec

This device, commonly known as AIC22C, contains two coders/decoders (codecs) for voice applications, including (VoIP). It features two analog-to-digital (A/D) conversion channels and two digital-to-analog (D/A) conversion channels that can be connected to a handset, headset, speaker, microphone or a subscriber line via an analog cross point.

In basic terms, VoIP allows the human voice to be transformed into packets of data and transmitted across the Internet.

TLFD240 – Power Line Codec

This device, known as Polly, is a single-channel Codec with integrated programmable filters used to enable voice and data communications over power line systems.

Powerline Communications digital signals connect the electronics in our home or office through the existing power lines within a building.

Advantages of Power Line Communications:

- No more wires, just plug in
- Share your Internet connection
- Move your computers and appliances where you want
- Easy to install and use
- high transmission rate, right now 3 Mbps (up to 30 times faster than ISDN) in uploading and downloading with speeds of 100 Mbps possible
- Secure data-encryption
- Utilizes existing power source for all your communications needs

Caesar – Cable Modem / Telephony

Caesar is a custom device that is being built for Tellabs Incorporated. This Codec is intended for Cable applications including telephony. This device contains two dies internally connected.
**Professional Development:**

A good thing to mention is the opportunities of professional development while working here at TI. I was given the freedom to enroll in different trainings and seminars that were of interest to me. My boss also recommended others that he knew would increase my knowledge and then I could apply this in my work area.

A very important thing in a semiconductor industry is to know how to handle the devices properly. For this reason I assisted to training on how to handle devices, like integrated circuits, that can are sensitive to Electro Static Discharge (ESD). This training was short but very specific and useful. I learned about the different ESD handling procedures including the different types of packages used to protect the devices.

I also learned of how charge our body can get even when sitting at the office. I was told about the protective items that I should wear while handling chips, like the wrist strap in Fig. 17.

Short after that training I assisted to a two-day training about dataPOWER. This training was held at another TI location located in Plano, TX like twenty minutes away from the Dallas site. Now I will give information about this software.
This software was custom made for several companies related to the semiconductor industry. It has many powerful tools for data analysis. Still, its stronger part is not used to much by our team. One of the great advantages is the analysis of wafers. It has many tools to analyze in a style named wafer mapping where it shows you a map of the studied wafer with different colors that let you know what type of failure each die has. Another great advantage of dataPOWER is that the user is able to connect to other servers to get the desired data. You can get data from Taiwan or any other fabrication site. There is also a tool to download the data from the web.

Figure 17: Histogram Tool in dataPOWER

With the creation of Excel macros our main use to dataPOWER is to convert the data from “stdf” format to a spreadsheet format. After this we can use this software to analyze the data as well but we prefer to use Excel. One of good thing about this software is the way it presents histograms and the ability of creating a summary with only the parameters of interest.

After learning how to use the data analysis tool available for me I also had to understand the concepts about statistics and Statistical Process Control. I was able to go to the introductory course in this matter. In this course I learned a lot about statistics and process variation. I was able to refresh my statistics knowledge from the course taken in the university. This training was very dynamic because we were doing exercise problems along with the course discussion. After this training I got a much more clear view about the importance of my work in TI. I also learn many techniques and the formulas behind those techniques to analyze and understand the behavior of the parameters in our devices.
My boss gave me the opportunity to enroll in a very famous course within product and test engineers. This course was about Mixed Signal Test & Measurement. This course in based on the discussion and explanation of a book written by an experienced TI worker called Mark Burns. Three professors presented the material from the university called Texas A&M. The course was very organized and was accompanied with demonstrations and examples. I considered that this course was very useful because I learned not only why we test each parameter but also how we test those parameters in mixed signal devices. For this course a review of the Fourier Transform was needed. Many of the tests we make in our devices are DSP based. The use of DSP saves us a lot of money in test time because the Fourier Transforms allows us to create multi-tones waves to test at more than one frequency at a time.

![Figure 18: Book Used in Mixed-Signal Course](image)

In the present time I am assisting to a seminar on Product and Test Engineering. This seminar is every Thursday for about 14 weeks. It is a very detailed seminar on how to be a good product and test engineer. This course starts with the basics on how semiconductors are fabricated and how transistors work inside a device. After this we are going to study how to create test plans for our devices and how to analyze data in the correct way. We were given a reference book on semiconductor fabrication. This book, Fig. 18, will be of great help when having problems with a device behavior.
On my behalf I am very happy with all the opportunities I have been given to learn and to adapt to my work area. All these courses are very expensive and maybe my boss expects me to come back after graduating to apply all the knowledge learn during my coop term; I will be happy to do so.

During my term I was also able to assist to different conferences and meetings. I will give details about them in this section.

As part of TI’s culture after every quarter ends a Quarterly Review is broadcasted live to all TI employees. Everyone gathers in conferences room to hear to the explanations given by the C.E.O. and vice presidents as well. Employees are encouraged to make calls directly to the executives while the broadcast is still on the air and then those questions are answered publicly.

The Human Resources staff made an activity called the Spring Appreciation Breakfast where all coops assisted with their respective manager and together ate breakfast. Afterwards a Senior Vice President of the company, Gregg Lowe, gave a speech about his experiences as a TI employee. It was a very nice activity and it was like a father-to-son reunion because all the students were accompanied with an adult.

As for meetings is concerned, being part of this team involved me with several of these. From the day a device arrives to our team every week the team get together in a meeting called New-Product Action Team. All the things that have to be done are presented in this weekly meeting and different actions and task are presented to the team members. After task start to be completed new actions are assigned as the product continues its way to be Released to Production (RTP).

Another meeting is the PCR as discussed before. Here we discussed all the problems encountered during the characterization process. Another important meeting is the Brach Meeting. This is a monthly meeting where the whole branch gathers and all the sections present their progress as well as their achievements and where they stand with respect to the products that are being developed and that are soon to be released to the market.
I have one more thing to talk about. It was required for all coops to create poster and present it in a small activity created by the Human Resources Team. This poster should contain information related to the assignments of each student. It was a great opportunity to show our work to others. All the posters were put in the sides of the main hallway in TI. Every employee that passed by could look at your work and ask questions about it.

Figure 20: Photo From Poster Session
Additional Information:

Now, I will talk about other matters that are not directly related to work. These additional things I will present are very important for a successful daily life. First I will talk about the costs of living in Dallas.

For housing I was very worried before coming here because of the fact that I was coming alone. No other students were coming to TI this past semester. Fortunately, another student was already here at Dallas and he agreed for me to be his roommate. The apartment complex is called Reflections of Highpoint. The cost of my apartment is $607. That left us with 303.5 per person. After this housing was not a problem because TI also reimbursed $150 dollar each month.

The place where we live is very close from our work and this saves us lots of time from the traffic jams. It is also a pretty quiet place and this makes it pretty nice to live in it. I am very satisfied with this apartment complex and would definitely recommend it to other students.

Even though our apartment was close to work and we could walk to it there are many other places that are good to visit and other necessities that can't be fulfilled by just walking down the street or getting a bus. So I started thinking in the possibility of renting a car. This idea soon vanished because my roommate had a car already and I had no one to split the cost of the rental. The after several months I would have invested a lot of money in car rental.

So I took the decision of buying a used car. I got a good deal on it and if I manage to sell it before leaving Dallas all or most of my investment will be recovered and a lot of money will be saved. Well to be honest it is not the best car in the world but it takes me to every place I want to go. After paying the bills each month some money was left to save and my bank account soon started to grow so hopefully I will go back home with some savings.

Now after saying that lots of money is spent I tell you about the things I did after working hours. Well, Texas is known for having everything in big amounts so you can imagine that there are many good places to go eat in big amounts too. Soon after arriving my wait started increasing drastically. I got a little worried and I decided to join a gym that is inside the facilities of TI. Every I can, I go with a friend to jog and lift some weights. After this I don't feel guilt anymore fore eating in big amounts.

After arriving I got in contact with some people that go to a church that is from the same religion that the church I go in Puerto Rico. I decided to join them on Sundays to support our group in Texas. This church is located in Arlington, 30 minutes from Dallas, so now it is clearly seen why I needed a car of my own. I have been a very nice experience to be able to go to this church.
While I was in Mayaguez I was part of the university’s Latin music orchestra “Alma Latina” playing the flute. I did not want to stop practicing so that I would not lose my skills so I brought my instrument to Dallas. When I have free time or start to miss my days playing the instrument I start practicing in my apartment, always trying not to disturb the neighbors.

Despite all the responsibilities that are involved at work there is always time to have some fun and enjoy of this city. I had the opportunity to go to see and NBA basketball game of the Dallas Mavericks. It was of great emotion for me because I had never gone to an NBA game. I had a lot of fun that night with other coops that also assisted. I am planning to go to a professional baseball game of the Texas Rangers. I know it will also be a lot of fun.

Here in Dallas there are also many places to go shopping. Every time I wanted to send a gift to my family I had a lot of choices of places to go shop. One of the biggest malls around has a place to ice skate just in the center of the mall. So there is no need to be in the north to go ice-skating.

Dallas movie theaters are also a good place to go to have fun. There is a theater in Dallas that has a DLP projector. This projector, created by TI, gives a picture quality that is amazing; definitely it is worthwhile to go see a movie with this new projector.

I also visited with a friend some museums, downtown Dallas and an auto show that came to town.

The opportunity of traveling cannot be wasted so I also used my car to go and discover new places. A few weeks ago the coops decided to do a camping trip to Lake Travis in Austin. We traveled for more than three and a half hours to get to the lake. It was a great place with pretty surroundings. Never before I had seen such a big lake. It was a great opportunity to see the countryside and the state’s capital city. We had fun swimming and building a campfire. Coming up in Memorial weekend I am going with a friend to San Antonio. We are just going down there to have the opportunity to see the city and its historical places. We will probably stay to sleep in the cheapest place or the first that we find when we get tired. We are also planning to drive to El Paso where a friend of mine is from. It takes about 10 hours to get there and it promises to be a great challenge for me because I have never been so much time in a car. The weather there is like a desert so I will experience that too.

Well to end my document I will tell you that there is probably an opportunity to take a class in a nearby college but my recommendation is that it is enough with the work because you won’t have too much time to study. Some of the nearby colleges are the University of Texas in Dallas or the University of North Texas.