

Brayden Hollis

Source Inspection Scheduling Calendar

Mentors: Tristan Olk and Ian Luczon

Jet Propulsion Laboratory

California Institute of Technology

I. Introduction and Abstract

Quality is an essential component for creating flight hardware travelling through space since the hardware is extremely expensive and cannot be reworked or repaired once launched. An important step in this process is ensuring the quality of hardware procured from Jet Propulsion Laboratory's (JPL) suppliers. An important element of determining supplier quality is source inspection. Source inspections are performed at suppliers' facilities by JPL employees to ensure that hardware characteristics are acceptable before being covered up and/or delivered to JPL.

Currently there is no systematic process for scheduling such inspections. The current process relies on phone calls and memory to schedule and perform source inspections. This ad-hoc method has led to missed inspections, late inspections and frustration on the part of suppliers, JPL quality management, and JPL project management. JPL Quality Assurance has identified this weakness as an area to improve and has begun redesigning the source inspection process. The most critical element of the improvement effort is the source inspection database. The database will store supplier, contract, and inspection information in a central location that is easily accessible by anyone within Quality Assurance. One of the core functions of this database is the source inspection calendar, which will allow the newly assigned Source Inspection Coordinator to input incoming source inspection requests, gather appropriate information, and identify available source inspectors. The calendar's functionality also includes the ability to manage the overall source inspection workflow, as well as provide the source inspectors with the accumulated information for their inspection. This system will bring order to the current chaos and ensure that source inspections are scheduled quickly, performed by an inspector with the right skills, and provide data for management to better oversee the process and resources.

II. Goals and Purpose

Upon arriving at JPL, my mentors and coworker instructed me about my project, working on the system for scheduling source inspections, as well as the group I was working for, Procurement Quality Assurance. As scheduling source inspections at that time was done through phone calls and memory of qualified inspectors, I was creating a system for a developing process. At the time of my arrival, they already had a general idea of what the new process would be and what I needed to create, yet there were still details and requirements that needed to be developed or clarified.

After receiving the requirements for my project, I started working. As I knew prior to my arrival at JPL that my project had an online aspect to it, I had already begun studying HTML programming before coming to California. I had a better understanding of my project; however, I still had little experience with both web-based and database programming. To remedy this, my mentor, Ian Luczon, had me play around with various programming languages in order to familiarize myself with them. In addition to HTML, Ian had me work with ColdFusion and MySQL. Some areas of special focus were querying, entering, updating, and viewing data from databases, as these were major functions I needed to incorporate into the calendar. Since my project would require users to input data, I also learned to create HTML forms to input data into the databases.

Once I became proficient in creating forms and working with databases, I started working on the calendar part of the project. The actual calendar was an open source jQuery plug-in called FullCalendar. Ian found this plug-in prior to my arrival and wanted to use it as it contained the ability to drag and drop events, making it easy to use. While I did not have to create the actual calendar, I had to figure out how the calendar worked, as well as how to use it with the source

inspection data. In order to accomplish this, I had to learn JavaScript, jQuery, and AJAX; languages that enhance the dynamic abilities of websites. Once I learned the languages and the plug-in, I was able to place events on the calendar from the database and save changes done on the calendar into the database.

Now that I knew how to get data from the user and display and manipulate the data with the calendar, my task was to combine the forms and the calendar so the user would be on one page. To keep the page small and tidy, Ian suggested using pop-ups for the forms and he pointed me to another open source plug-in, jQuery User Interface (jQuery UI). This plug-in had many widgets and features that allowed for a more user-friendly website, including the dialog box I used for my input forms. These dialog boxes allowed me to add multiple forms that would only pop-up when needed, keeping the page simple and orderly.

The next task was creating the ability to schedule inspectors for each inspection. The first part to scheduling an inspector is having a list of inspectors. To simplify the process, the list needs to be filtered by inspectors capable of performing the inspection. Furthermore, the requirements require only available inspectors be shown. I created a program to perform these functions, outputting the list as a table. I was limited to only knowing availability in regards to other inspections. Furthermore the process for determining capability is still being developed. Nonetheless, the general functionality to generate available and capable inspectors and schedule them was created.

Throughout this entire process, I focused on making this calendar user-friendly and as efficient as possible. First, since a lot of the information needed for source inspections already exists in Oracle and other databases, I programmed portions of the dialog boxes to automatically fill the fields in the source inspection database with the information available. This prevents

typing errors and saves input time by the user. This was done by having the user input the purchase order (PO) number. The program then generates a list of the PO's line items, pulling the information from a PO database. Upon selection of the items to be inspected, the contract information required for inspection was automatically filled into the input form. Another user-friendly interface enhancement was an autocomplete function for fields with a set list of possibilities. This means that the user begins typing and a list of possible options is generated, continually narrowing down the selections as the user continues to type. Furthermore, I have the calendar send out a Microsoft Outlook Calendar invite to the inspector for the inspection once the inspector and inspection data have been confirmed. Attachments also can be added to the inspection events, and then are included in the calendar invite, allowing the inspector to have all the necessary information for the inspection. The calendar is color-coded, so the user knows at which stage the inspection is in the scheduling process. Lastly, the inspection information is viewable by right clicking on the calendar event, allowing the user to check the information.

Overall, my project ended with me creating a calendar that allows source inspections to be scheduled in an organized system. The calendar allows for inspection events to be created, while pulling information to save the user time. Inspections are also editable and updated as needed. Furthermore, it allows for scheduling a qualified and available inspector. Lastly, it gathers all the information needed for an inspection and sends it out to the inspector. The calendar organizes and improves the source inspection scheduling process.

III. Impact of Internship on My Career Goals

Spending ten weeks working with JPL's Procurement Quality Assurance and developing the source inspection scheduling calendar has been very beneficial, even though it is not directly

related to my career goals. As a computer science major, programming and developing programs is a major part of my education, but most of the time the programs created seem unimportant, so this experience of creating a program that will be used by a real business is encouraging and beneficial. This process is encouraging as it shows that what I have been learning in school is applicable to the business world and that I have skills that I can bring to the table. It is also very beneficial, as I have been able to see the process of developing a product in action. While my program is for internal use, I still am creating it for the group and thus I had to meet with them throughout the process to make sure that I was creating what they wanted.

My current career goal is to work in cyber security and while this internship was not directly working in that field, it did help me along that path. First off, while I am a computer science major, I have not previously programmed websites. For this internship I have learned a great deal about web-based programming, which in itself has furthered my skills, but as a great deal of computer security deals with networks and the world wide web, by learning web-based programming, I am on the path towards my career goals. Furthermore, during my internship, a major cyber-security expert came and gave a talk that I was able to attend. This talk further my career aspirations by giving me some steps to take to further myself along my path to computer security.

Additionally, my time at JPL has helped me in my professional development by showing me more opportunities I could follow. As the world is becoming more and more reliant on computers and the internet, by learning web-based programming, I have been exposed to another career path that I could follow if I so desired. In addition to the security talk I attended, I attended multiple talks and laboratory tours at JPL, which have also shown me more of the

possible careers I could pursue, as well as just being educational about the world, universe and JPL.

IV. Acknowledgment

This research was carried out at the Jet Propulsion Laboratory, California Institute of Technology, and was sponsored by the Motivating Undergraduates in Science and Technology (MUST) Project and the National Aeronautics and Space Administration.