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Improving Data-Driven Decision Making within the USPTO

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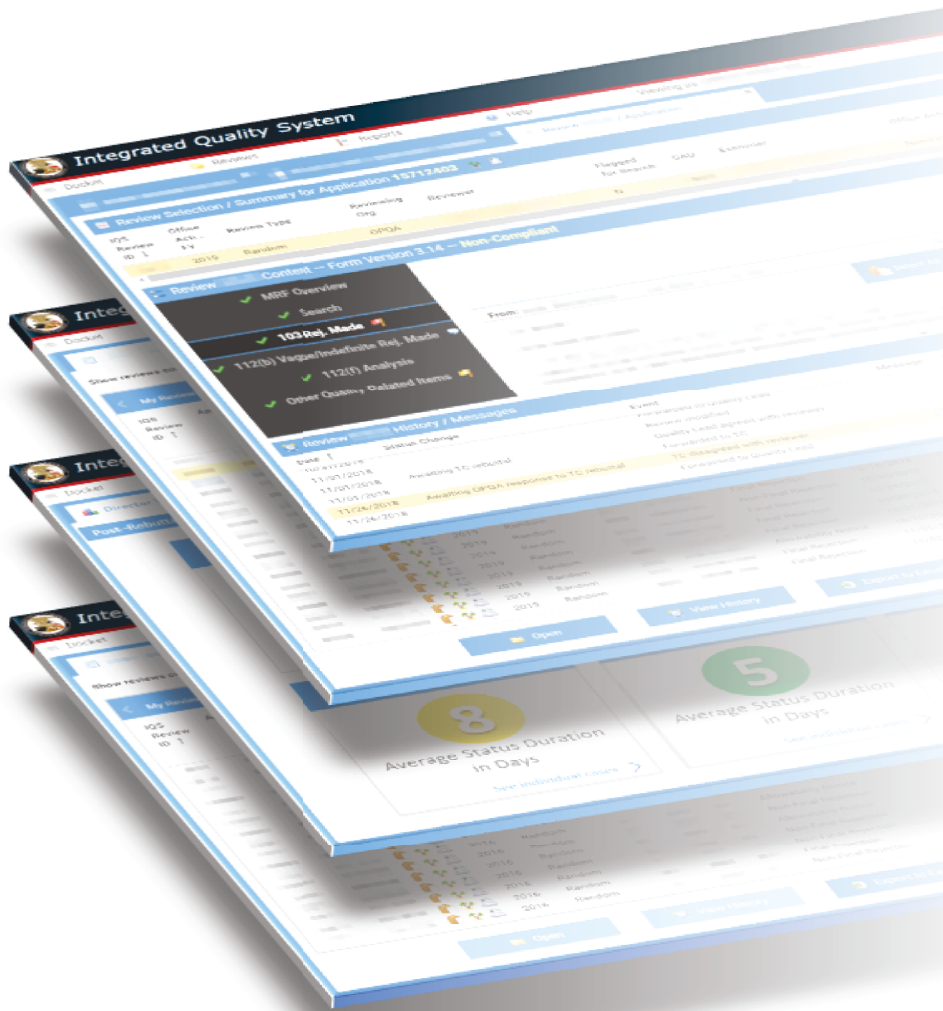*Worcester Polytechnic Institute*

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Improving Data-Driven Decision Making within the USPTO

Abstract

The United States Patent and Trademark Office is working to improve its current database dashboard website, the *Integrated Quality System* (IQS). The goal of this project was to assist the USPTO in evaluating their current system and to develop recommendations to improve data-driven decision making within the Office of Patent Quality Assurance and Patent Operations. To achieve this goal we interviewed several representatives of the two primary user groups to identify their information needs, created mockup dashboards through an Iterative Design Process, and developed a list of specifications to guide the future development and implementation of operational dashboards.

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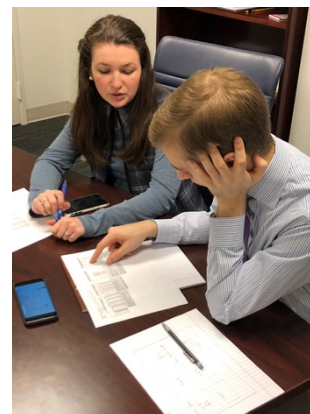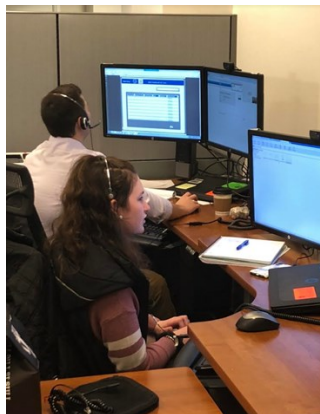PATENT AND TRADEMARK OFFICE

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The United States Patent and Trademark Office (USPTO) strives to maintain a venerable reputation, ensuring that the patent process remains respected. The Office of Patent Quality Assurance (OPQA) and Patent Operations help monitor various metrics associated with patent examiner decision-making in an effort to maintain correctness and consistency. However, the USPTO's data is not easily accessible to all user groups, leading to an underutilization of data . As a result, the USPTO is exploring better ways to display its data and add functionality to its data displaying web-application in order to address the diverse needs of its employees.

The goal of this project was to design a set of mockup dashboards for displaying quality data. This enables managers to make more data-driven decisions and allows patent examiners and reviewers to track their personal performance metrics. Dashboards are data visualization tools that display an at-a-glance view of key metrics. Our objectives to create these recommendations are as follows:

1. Understand Best Practices for Displaying Data
2. Understand the USPTO Quality Review Process
3. Conduct a Needs Assessment
4. Create Initial Dashboard Prototypes
5. Test and Refine Dashboard Prototypes
6. Construct Design Specifications

Patent Examination and Quality Assurance Review at the USPTO

The United States Patent and Trademark Office (USPTO) plays a crucial role in ensuring that original ideas receive the support and pro-

tection they deserve. Before a patent application makes its way into the USPTO, countless hours have already been spent by the applicant and their patent attorney ensuring that the application is not wasted on an innovation that already has been patented and developing a strong argument about why the invention is both unique and patentable. When the application reaches the USPTO, it is placed in the correct subject area, known as a Technology Center (TC), and is held until a patent examiner with expertise in that area has the availability to review the application. Following the review, the patent examiner issues a decision to either allow the issuance of a patent, send it back to the applicant for further clarification, or deny the application based upon a type of non-compliance.

Although patent examiners comprise much of the patent office, the organization also has executives, OPQA, and Patent Operations to ensure the correctness of the patent decision. If a violation is discovered, the allegation is forwarded back to the managers of the patent examiners, who are a part of the Patent Operations Team. If managers dispute these findings, they can request reassessment. If the findings are upheld, the violation would be documented on the patent examiner's record. If the claim is dropped, there is no indication of the allegation on their record.

Overview of the USPTO

The USPTO's purpose is to issue patents and register trademarks. The criteria that a patent or trademark application must meet are defined by law. The USPTO examines each patent application against these criteria before accepting, or 'allowing,' the application. Each application is examined by an examiner who is specialized in the field of the invention.

Patents serve the purpose of encouraging innovation for the benefit of society. In exchange for publishing a full disclosure of his or her invention to the public, including all information necessary for a person of reasonable skill to replicate the invention, an inventor is granted a right to exclude others from manufacturing, using, selling, or importing the invention for a limited time. This limited right encourages innovation because inventors may not be motivated to create unique inventions if those inventions could be immediately "stolen" by others. Once the term of the patent has expired, society may freely exploit the invention and has the necessary information to do so, thus contributing to the advancement of technology.

The USPTO's patent examining operations account for a large majority of its workforce. Two-thirds (8,147) of the USPTO's 12,588 employees are patent examiners (USPTO, 2017). The USPTO's patent examining corps is divided into nine Technology Centers that handle patent applications in broad fields, such as "Chemical and Materials Engineering" or "Communications" (USPTO, 2018b). Each Technology Center is composed of Art Units that specialize in specific areas, such as adhesive bonding or 3-D animation (USPTO, 2018c; USPTO, 2018d). Through this organizational structure, the USPTO distributes patent applications to examiners that are knowledgeable in their relevant subject areas. After a complete patent application is submitted, an examiner looks over the application and issues an Office Action if he or she finds any problems with the application, and the applicant is given a deadline to respond. Figure 1 shows the flow of decision making involved in the U.S. Patent Application Process. If the applicant disagrees with the examiner on the Office Action, the applicant may argue his or her position. The applicant may also amend his or her application to make it acceptable to the examiner. If, after the applicant's response, the examiner's concerns are not resolved, the examiner usually issues a Final Action. If the applicant still disagrees with a Final Action, the applicant may appeal to the Patent Trial and Appeal Board (PTAB), which is a part of the USPTO. If the PTAB affirms the examiner's decision, the applicant may appeal to the U.S. Court of Appeals for the Federal Circuit. In any case, when an application is found to be acceptable by the USPTO, it is allowed, and a patent is granted (Bouchoux, 2016).
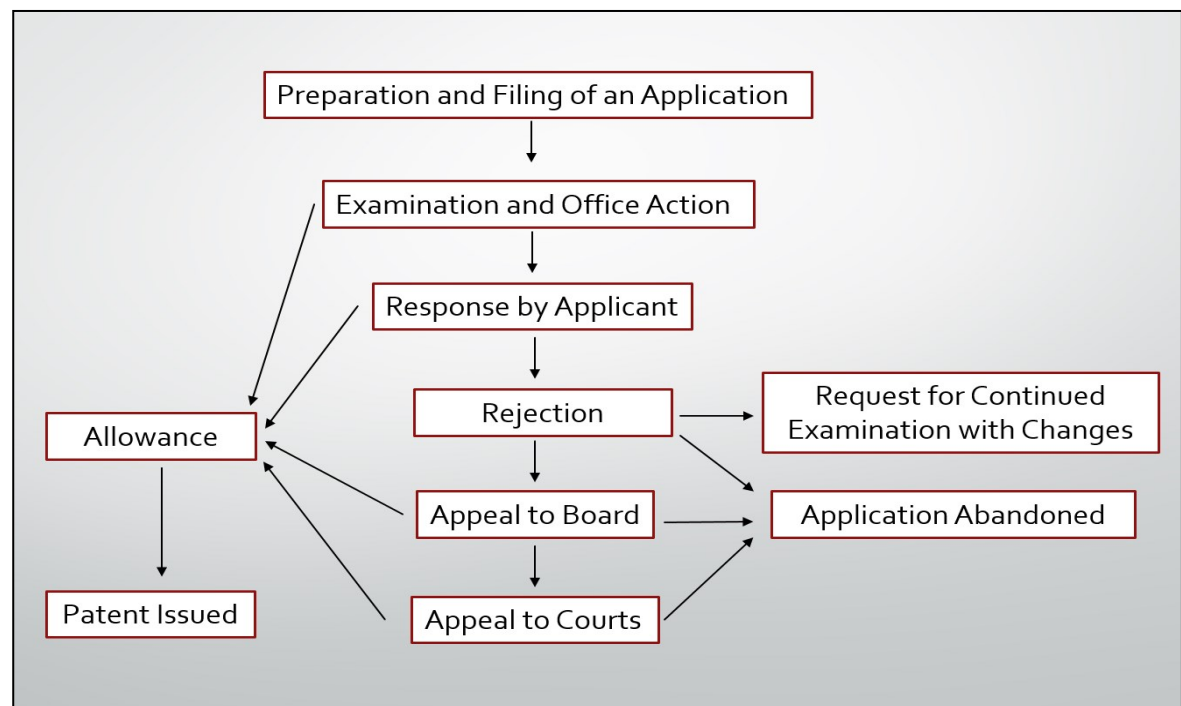

Figure 1: U.S. Patent Application Process

The Office of Patent Quality Assurance

The OPQA analyzes and assesses the quality of the patent examiners' work. The USPTO does not want reviewers to issue a patent when it should not be issued, but they also do not want to deny an application when it should be approved.

As observed in the diagram to the right, the Patent Office is divided into two sides. The right side, known as the Patent Operations side, contains far more employees than the OPQA. The OPQA (left column of Figure 2) consists of a Director, Quality Leads (QLs), and Review Quality Assurance Specialists (RQAS). The Director, Dan Ryman, is assisted by Chief Statistician Martin Rater and Reviewer Kathleen Bragdon. Eight Quality Leads each supervise about five to six RQAS. RQAS are former patent examiners who have proven their expertise through high quality patent examination ratings. These 65 reviewers "spot-check" the correctness of patents issued (whether they have been rightly rejected or rightly accepted) through a process known as Office Action review. The reviews are organized by technical discipline and are overseen by Quality Leads familiar with that discipline. Other than managing the RQAS, the main purpose of the QLs are to verify inaccuracies found by an RQAS before sending the information to the Patent Operations Team, who completes the claim. In total, the Office of Patent Quality Assurance consists of around 85 employees.

To monitor the accuracy and efficiency of the patent approval/denial process, the OPQA completes three major tasks that define their overarching mission statement. One task consists of conducting reviews of an examiner's work by sampling and assessing their decisions. The second task is analyzing additional quality data to report quality metrics and trends. These metrics consist of consistency data within the TCs and include production statistics and timeliness data. The third task is to assist technology centers with their quality improvement efforts. This includes developing plans or training that might help patent examiners improve their accuracy and consistency in the future.

To better limit the number of inaccurate patent decisions, RQAS assign quality scores to the patent examiners' decisions by looking at various factors such as a patent's compliance to government standards and how clear and consistent these issuing decisions are. The OPQA management also observes production metrics and best practices of examiners, along with reviewing internal and external surveys about applicants and others' perceptions of the process. In order to better record all this information, the OPQA has categorized quality metrics into three types or "indicators": Product, Process, and Perception.
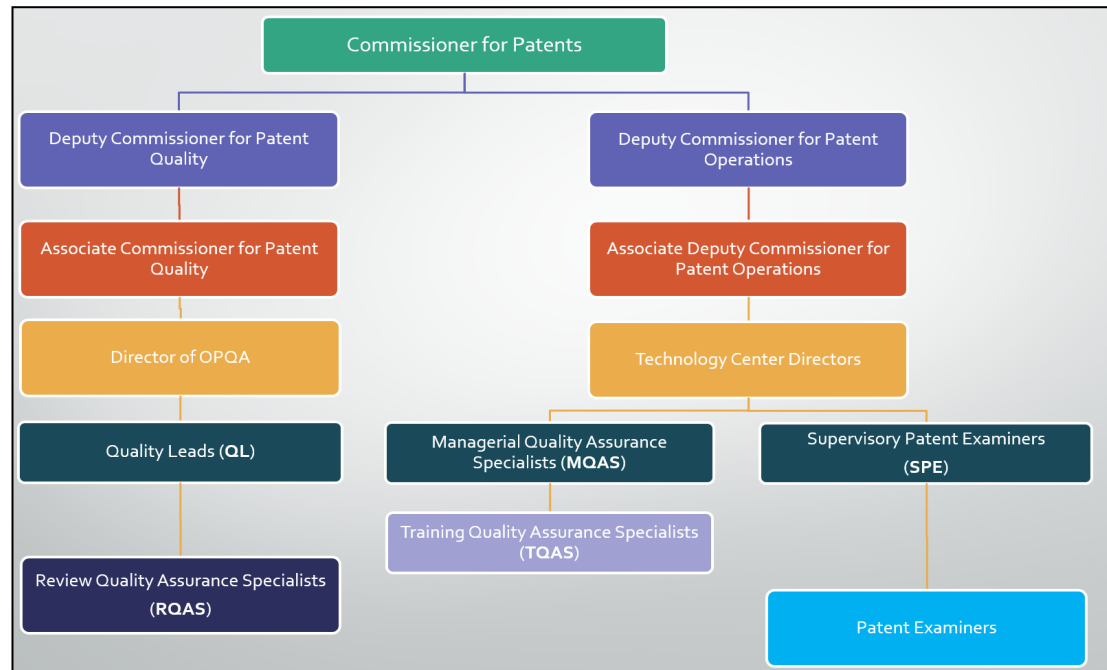

Figure 2: OPQA and Patent Ops Divisions

Product Indicators

The major purpose of Product Indicators is to gauge *correctness* and *clarity* of the patents. *Correctness* concerns how well the patent complies with Title 35 and if the issued patent complies with all relevant case laws at the time the patent was issued. Therefore, correctness assesses how well the patent issued follows the code of patent law and how well it follows precedent in the United States.

Clarity, on the other hand, is not as well-defined. The current process to determine clarity uses only a Master Review Form (MRF), which helps the RQAS analyze the day's sample of patents for Improper rejections and any failures to reject wrongly approved patents. The MRF has a smart-form modular design that includes 20 modules and 330 questions regarding correctness, clarity, and patent best practices. This twenty-five-page document guides RQAS to record the correctness of how well the filed patent applications match various statutes as well as to clarify the rationale of every rejection in an Office Action. Overall, the Product Indicators are used to check the accuracy of patent decisions based on how well the patents comply with the applicable laws and precedents of the United States.

Process Indicators

The OPQA uses Process Indicators to track the efficiency and consistency of their own internal processes. These metrics specifically focus on monitoring the internal process affiliated with patent reviews. This helps ensure that the Quality Leads and RQAS are on track and consistent in the feedback that they are providing to TCs and patent examiners. This consistency increases their credibility throughout the USPTO.

With the emerging goal to encourage the conformity of the Quality Leads and their RQAS, the Director of the OPQA has created an *Award Plan for OPQA QLs* for the 2019 Fiscal Year. This award plan pinpoints the four major goals that the Quality Leads should be aware of when regulating their internal processes. The first goal of the program is to ensure the consistency of production numbers. Each Quality Lead team is expected to complete a set number of reviews based on its size each year. The OPQA wants these reviews to be spread out evenly from quarter to quarter to ensure proper sampling year-round. As a result, goal one of the plan awards a set number of points for compliance to these quarterly production goals. The second goal focuses on the timeliness of the QL output of alleged non-compliances. Every time that a RQAS disagrees with the patent decision that they are reviewing, they must mark the discrepancy and forward the alleged non-compliance to their QL. The QL is then required to double check the alleged non-compliance and either pass the claim along to the TCs for further review or send it back to the RQAS for further clarification. Goal two of the award plan looks solely on the turnover rate; simply put, this metric is the time between the QL receiving the alleged non-compliance and the QL making an initial decision on the claim. Goal three of the plan consists of the proper creation and installation of the QL's consistency action plans. Finally, goal four focuses on quality control of their RQAS' work. This goal encompasses all the reviews of the RQAS including randomly sampled rated cases, tracking of their reviewing results, workload framework, and other quality control metrics. Figure 3 illustrates these goals.

Overall, the implementation of the *FY 19 Award Plan for OPQA QLs* allows the OPQA to internally focus on the Process Indicators that matter most to them during this time. By focusing on consistency and efficiency of production,

Figure 3: Quality Lead Award Plan for FY19

timeliness, quality assurance, and internal quality control audits, the OPQA is able to increase uniformity throughout the organization.

Perception Indicators

Perception Indicators are developed on the basis of surveys that poll staff and clients about their perceptions of the OPQA and the ease of the patent application process. Semi-annually, the OPQA surveys a random sample of 750 internal patent examiners and a random sample of 3000 patent lawyers and frequent-filing customers. The internal surveys ask patent examiners questions regarding their satisfaction with the software and instruments available for their use, training opportunities, and internal coaching. It also asks the examiners to rate how completely and clearly customers completed the process applications. The external survey includes questions about the respondent (such as their affiliation and what type of patents they most frequently file), how well they believe the examiners have been adhering to certain rules and procedures, their perspective on rejected patents, and their overall satisfaction with the patent application process. These polls are primarily taken by an independent third party and the feedback is retained in a central database. These poll results can then be represented in multiple bar and line graphs to compare perspective and compliance of customers of the USPTO.

Patent Operations

The Patent Operations Department (Patent Ops) is the rightmost subgroup (see Figure 2) of the United States Patent Office under the Commissioner of Patents, Drew Hirshfeld. The Patent Ops team's goal is to coordinate the examination of applications and all the patent-examining functions for each TC. Each of the nine TCs within the USPTO consist of an Associate Deputy Commissioner for the TC, three to four TC Directors, one Management Quality Assurance Specialist (MQAS), one to six Training Quality Assurance Specialists (TQAS), many Supervisory patent examiners (SPEs), and even more patent examiners.

The major role of the Associate Deputy Commissioner is to serve as a contact point for the Directors of the TC. Every TC has multiple Directors, each overseeing certain sub-disciplines, or work groups. For example our sponsor, Daniel Sullivan, is a Director within Technology Center 1600. TC 1600 is the *Biotechnology and Organic Chemistry* center but it is broken down deeper into more specific categories. In this

case, Daniel Sullivan is the Director of *Organic Chemistry* (1620) and *Fermentation, Microbiology, Isolated and Recombinant Proteins/Enzymes* (1650). There are two additional Directors in Technology Center 1600 who cover the additional four sub-disciplines. Figure 4 shows a partial breakdown of TC 1600.

Each Technology Center sub-discipline is further broken down into Art Units. There are approximately ten Art Units per sub Technology Center. One SPE is assigned to oversee each Art Unit. Each SPE's major role as the lead of the Art Unit is to manage the patent examiners within that discipline. This includes performing "spot-checks" on the examiners and ensuring that production goals are met within the Art Unit. The SPE's other primary job is to sign patent allowances for each Junior
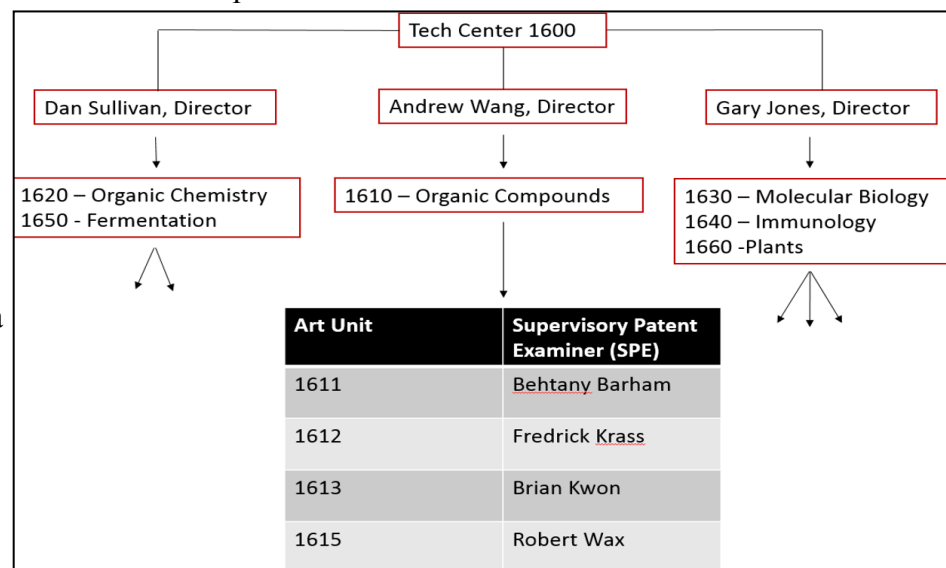

Figure 4: Partial breakdown of TC 1600

Patent Examiner since they have not yet received the proper training to sign patents on their own.

In addition to the sub-disciplines and Art Units in each Technology Center, there is a group known as the Quality Assurance Specialists (QAS) who assist the entire Technology Center. The leader of the QAS is known as the MQAS, who issues performance ratings on the TQAS and assists with alleged non-compliances when needed. Training Quality Assurance Specialists have two major roles. The first role is to make decisions about alleged non-compliances that come from QL's in the OPQA. The second role is to analyze information about the patent examiners, find common themes and trends that could use improvement, and develop training materials to increase the examiners' skill level along with improving consistency throughout Art Units and the technology center as a whole. TQAS have the most direct contact with the OPQA.

Best Practices for Dashboard Design

A dashboard can best be described as a platform for decision making that functions by providing the right information to the right person at the right time (Kerzner, 2017). Dashboards provide visual representations of data and how they measure up in terms of specific metrics the user is interested in. The most effective dashboards focus on one overarching goal or purpose and display relevant metrics in a

Figure 5: Sample Operational Dashboard

clean and concise manner. All dashboards consist of two parts: the front-end and the back-end. The front-end is the user interface and contains visuals, like dials and charts, which allow the user to access important information in a way that optimizes readability and ease of use.

The back-end is a collection of queries that pull information from databases and channel the data into the front-end visuals. There are three main types of dashboards: strategic, analytical, and operational. Strategic dashboards provide key performance indicators that company executives track and provide these executives with a high-level overview of the current state of their office. An example would be monitoring data on the success of a new sales strategy and tracking its performance on a line graph. An operational dashboard can monitor the implementation of a new type of complex business system at the operational level such as monitoring airplane maintenance activity and seeing how many airplanes have been grounded because of major malfunctions in near real-time. Figure 5 is an example of this type of dashboard because it shows data in real-time [note: certain widgets are entitled as "today"] and has the ability to be

filtered, by "Program" for example. Lastly, analytical dashboards display operational or strategic data and include drill-down functionality which allows the user to analyze data more effectively.

An example of drilling-down on an analytical dashboard would be clicking on a sales representative on a pie chart that shows all sales representatives by their total sales for the year. Clicking on a sales rep would filter out every other visualization, hiding data from other sales representatives in order to highlight the current representative (Bremser & Wagner, 2013). The USPTO dashboard mockups created were made to be analytical.

In addition to the three main types of dashboards there are also two ways of portraying data, either in static or real time. Static dashboards must be updated periodically but do not show data in real time. However, they can visualize trends over time with one example being a line graph of monthly revenue invoices over a year. Real time dashboards involve data that is updated at least once a day if not minute by minute. They are often pulled from a database that is used daily by other employees. An example of this would be an aircraft maintenance report for hundreds of aircrafts a day which is updated daily in order to monitor alerts and analyze average maintenance time. This would best fit with analytical and operational dashboards (Bremser & Wagner, 2013). There are five components to designing a fully functional dashboard as shown in Figure 6.

These five steps ensure an optimal dash-

1. Define the dashboard objective: decide what type of dashboard to implement and which form of data to use (real time or static).

2. Define the dashboard metrics: which types data or variables in the needs to be visualized and how

3. Talk to the users of the dashboard: determine which measurements are important to include.

4. Design, build and test the dashboard: steps three and four are iteratively repeated until the dashboard is ready for publication. This step will be the largest and most time consuming.

5. Publish and maintain the new dashboard: maintenance could include minor tweaks in visualizations or adding new data to the existing dataset (Bremser & Wagner, 2013).

Figure 6: Steps for Dashboard Design

board that is both structurally and functionally sound. User feedback is essential in measuring the success of a dashboard and improving it over time. Periodic surveys about the helpfulness and effectiveness of dashboard metrics can really help keep visualizations and performance measures up to date.

There are also several best practices to take into account when designing a dashboard. First,

know the audience. They will be the users the designer should consult both at the beginning and at the end of the dashboard creation process, as they will want a dashboard tailored to their needs. Second, choose the right type. Whether it be strategic, analytical, or operational, utilizing the right type of dashboard is a key component to its usefulness. Third, use space wisely. Arrange everything on a dashboard with the idea of flow and efficiency in mind. Typically, the more important and larger points are located at the top of the screen and the visualizations that represent more granular data are at the bottom of the screen. Fourth, use the right visualizations. Choose visuals based on the information you are trying to relay (e.g., change over time is best represented through line graphs). Lastly, keep the data refreshed and find out how often your dashboard's data needs to be updated.

Altogether, dashboards are a popular platform for companies and organizations to utilize in today's business environment. With the large amount of data being produced, especially in the OPQA and Patent Ops, dashboards are a good way to consolidate and cleanly convey the data.

Methodology

The following objectives will describe how we gathered the needs of our respective user groups within the Office of Patent Quality Assurance and Patent Operation teams and utilized an Iterative Design Process. We designed, refined, and ultimately created mockups with de-

sign specifications that contained useful features and visualizations for the Patent Office to review and potentially implement into their existing database software, the *Integrated Quality System* (IQS).

Objective 1: Understand Best Practices for Displaying Data

Through reviewing expert literature and sample dashboards, we learned about best practices for designing and developing dashboards. These tools fueled our interviews and our mockup process and streamlined the way we approached each dashboard for maximum efficiency.

Objective 2: Understand the USPTO Quality Review Process

Through reviewing the USPTO website materials and meeting with our sponsors, we were able to gradually understand the inner workings of the Patent Office. By understanding the breakdown of different departments and their goals, we were able to better assess the needs of each user group and how to satisfy those needs. We were also able to better understand what current tools and metrics each group uses and how they can each be altered or improved.

Objective 3: Conduct a Needs Assessment

We conducted a needs assessment of the three primary user groups (see Table 1) to identify data and tools that each user would like to have available to them in their current database.

To assess their current needs, we interviewed a variety of key members in each group and discussed how they wanted to use the dashboard and the metrics they wanted to see. For the OPQA (Group A), we interviewed seven Quality Leads in one structured group discussion and seven RQAS (five individually and two together). For the Patent Operations Division (Group B), we met with nine MQAS, nine SPEs, and nine Directors. Each meeting consisted of one MQAS, SPE, and Director grouped according to their Tech Center. For each group, the first few meetings involved brainstorming ideas for metrics to include until a consensus was reached. In the last few meetings, we presented a list of potential features and started each meeting by describing each feature and asking for any feedback or additional ideas.

Objective 4: Create Initial Dashboard Prototypes

Using feedback from the needs assessment and our research of best practices in dashboard design, we created an initial user interface design for the dashboards. These mockups simulated what the final products might look. This could consist of the kinds of graphs, tables or other visual data summaries that could be implemented into IQS.

Objective 5: Test and Refine Dashboard Prototypes

After we created our first mockups, we moved to the testing and refining process. First, we conducted several follow-up interviews where we demonstrated our current mockup, received feedback, and refined our interface before our next round of meetings. This cycle of designing, receiving feedback, and improving is called the Iterative Design Process. We used this process with each user group to create two

Table 1: Three Dashboards for Two Divisions

OPQA (Group A)	Patent Operations (Group B)
1. Management and Quality Leads (10)	3. Directors (40), MQAS (9) & SPEs (500+)
2. RQAS (65)	

or three improved versions until the final mockup was complete.

Objective 6: Construct Design Specifications

Our final deliverable consisted of our mockups accompanied by detailed design specifications. These design specifications provided the majority of the information that we believe should be implemented into IQS and why. These include details such as a list of the main features and visualizations requested by each user group, the purpose of each item, and how often to refresh each item.

The purpose of the specifications were to complement the mockups with detailed information on each visual and feature. On the other hand, the features that were solely based upon functionality and usability improvements were only mentioned in this document because there was no true benefit of mocking it up. The end goal of our deliverables is for our sponsors to look at the combination of specifications and mockups to utilize as ideas of what to ultimately implement into the IQS database.

Overview of the Results

By speaking with various individuals from each user group we were able to summarize the main features that we believe would be most beneficial for the Quality Leads, RQAS, and Patent Operations employees. After summarizing our interview results (*see section D of Sup-*

plemental Material for specific information), our team was able to produce a list of most requested features, along with visual aids to support these needs. Please note that the visual aids do not include real names or data in order to preserve confidentiality. In instances where our mockup contains a manipulated screenshot of information, we removed any personal information to ensure confidentiality of employees and of USPTO data. Figure 7 illustrates the overall structure of the discussion that follows with subsections describing the needs, features, and mockup dashboards for each user group. We also created a set of *Design Specifications* as a final deliverable to provide the USPTO details that can be used in designing and implementing operational versions of the dashboards.
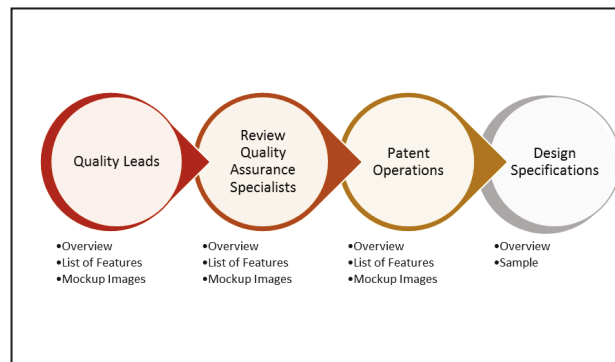
Figure 7: Results Overview

Quality Leads Dashboard

After meeting with multiple Quality Leads and receiving a packet of brainstormed data from the Quality Leads Data Team, we were

able to understand the major metrics that the QLs wish to have added into the Integrated Quality System (see Figure 8 below). The pages would be included under the current report tab, a preexisting tab in IQS.

Figure 8: QL Dashboard Requests

Among the requests for modifications, we noticed two themes. First, the Quality Leads wanted new metrics and visuals in IQS but many were very adamant about utilizing tables over more conventional data visualization techniques (e.g. Bar Charts, sliders, etc…). This is because QLs wanted the ability to export all data from tables to a Microsoft Excel spreadsheet for further use and manipulation. Another overarching feature that was requested by many QLs was the ability to filter out data points or columns that they deemed unnecessary. This would introduce a widget type functionality that would increase customizability for each individual user.

RQAS Production Data

Managing the production of the Quality Lead's RQAS is a major task. QLs must ensure that each RQAS is meeting his or her bi-weekly production goal, while also being aware of the results of each Master Review Form (MRF) that he or she completes. Currently, there is not a convenient way to access these statistics without requesting statisticians in the OPQA to pull a custom table.

When completing a MRF review, an RQAS makes decisions that can be categorized in three main ways – Noncompliant, Attention Needed, or Pass-through. In addition, they also have the option to give an examiner an accolade, or recognition, when he or she does an extraordinary job. After discussions with multiple QLs, we recommend that this information should be portrayed in three forms: (a) a table, (b) progress bars, and (c) vertical clustered bar chart.

(a) As seen at the top of Figure 9, the first visualization that we recommend implementing into IQS is a table that displays each RQAS' total production percentage of their production goal (*see b for more information*), the number of accolades given in that time period, the total amount of MRF reviews completed, and the percentage of those reviews in each decision category. Adding a time period filtering ability helps increase the functionality of the proposed dashboard. Adding an export option allows each QL to export the displayed data and manipulate it in Excel as they see fit. [Note: non-compliance is the first production category in
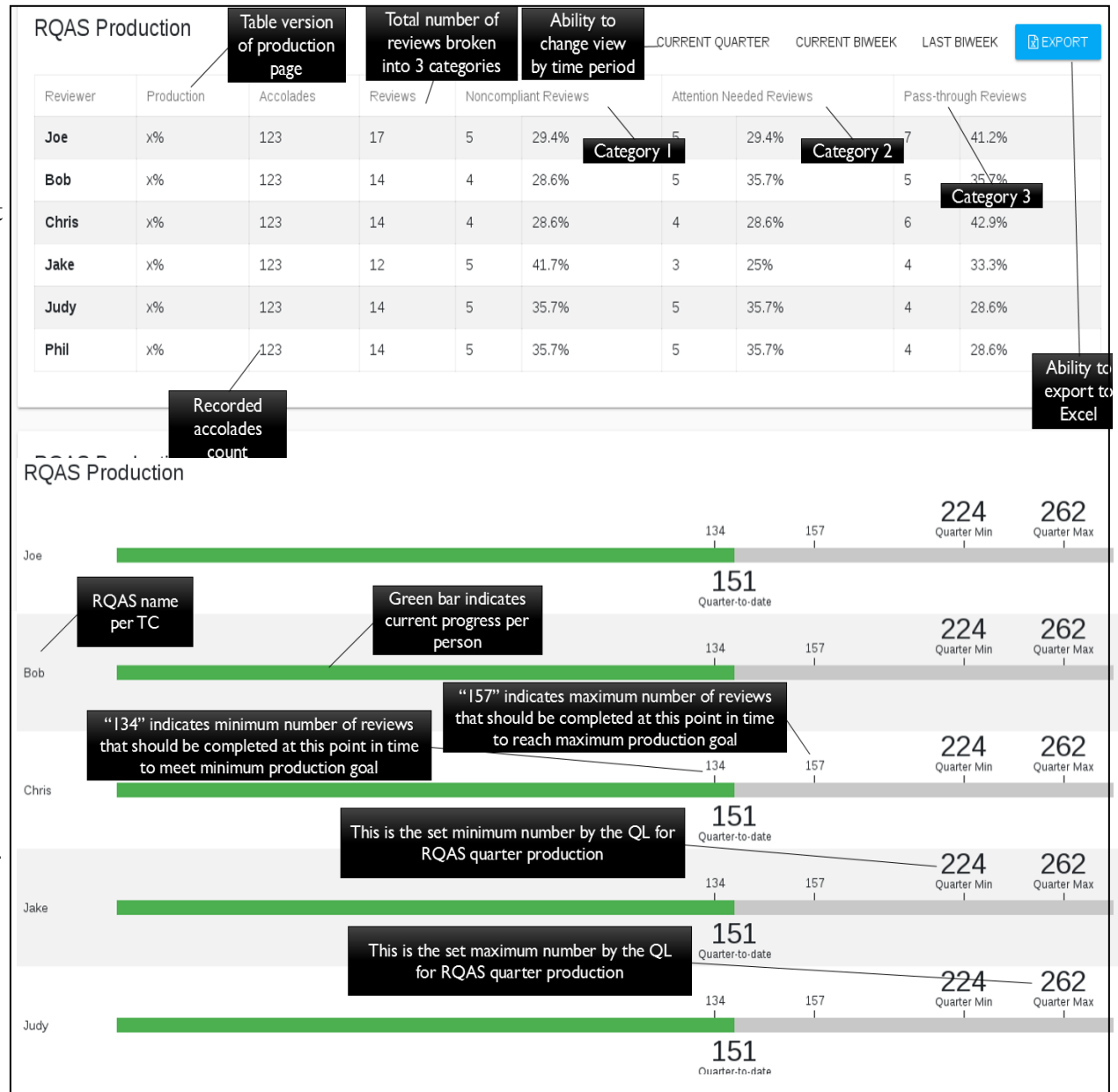

Figure 9: RQAS Production Data (1)

the table due to its higher importance.]

(b) As seen sat the bottom of Figure 9 the second main component is a progress bar visual aid. There is one visual aid per RQAS in the QL's TC. This display should have two options. (1) Every pay period (or every two weeks) each RQAS is assigned a production goal from their QL and their progress towards this goal would be displayed here. (2) Every quarter an RQAS has an approximate goal of MRF reviews that they must complete. The quarter view of the production bars would include "time markers." These "time markers" indicate the amount of reviews that should be completed by that particular point in the quarter to maintain the proper speed to meet the overall goal. Minimum and maximums are included to provide a visual representation of the range. The green color in the progress bar represents the amount of reviews complete, while the grey represents the empty bar. [Note: The progress bar does not necessarily need to be completely filled to meet the goal.]

(c) As seen in Figure 10, we recommend the data from the table is additionally expressed as a vertical clustered bar chart. These bars (Noncompliant, Attention-Needed and Pass-through) represent the percent of reviews presented in each category per RQAS. This allows the QL to see which of their RQAS are higher in which categories and vice-versa. This helps the QL easily regulate which percentages are higher in which categories. There is also an option to change the percentage to pure quantity for an alternate viewing platform. [Note: non-compliance is the first production category in

the table due to its higher importance.]

RQAS Consistency Data

A major initiative of the OPQA for the future is to be more consistent within their own TCs and the entire office as a whole. This information is not currently displayed in IQS and it is a multi-step process to pull the data manually.

We recommend that the OPQA condenses this data into two interactive graphs in order to best display outliers in regards to alleged non-compliances throughout the QL's TC. The goal of identifying outliers is not to punish those who are different, but to spark conversation as to why they are outliers.

We propose that the data should be dis-

played in terms of percentages and in standard deviations for multiple view types.

As seen in Figure 11, Option 1 is a vertical clustered bar graph created using percentage values. The RQAS names or numbers would be displayed with their Omitted and Improper bars. The total percentages of non-compliance would be broken down by statute, and further more by Improper vs. Omitted (when applicable). We also recommend a few additional features to ease the readability and productivity of this graph. In order for the QL to see how each RQAS compares to the average of both Improper and Omitted rejections in the specified statute, we recommend inserting a dotted line at the average percentage value. This, once again, gives a visual representation of each RQAS compared to the others.
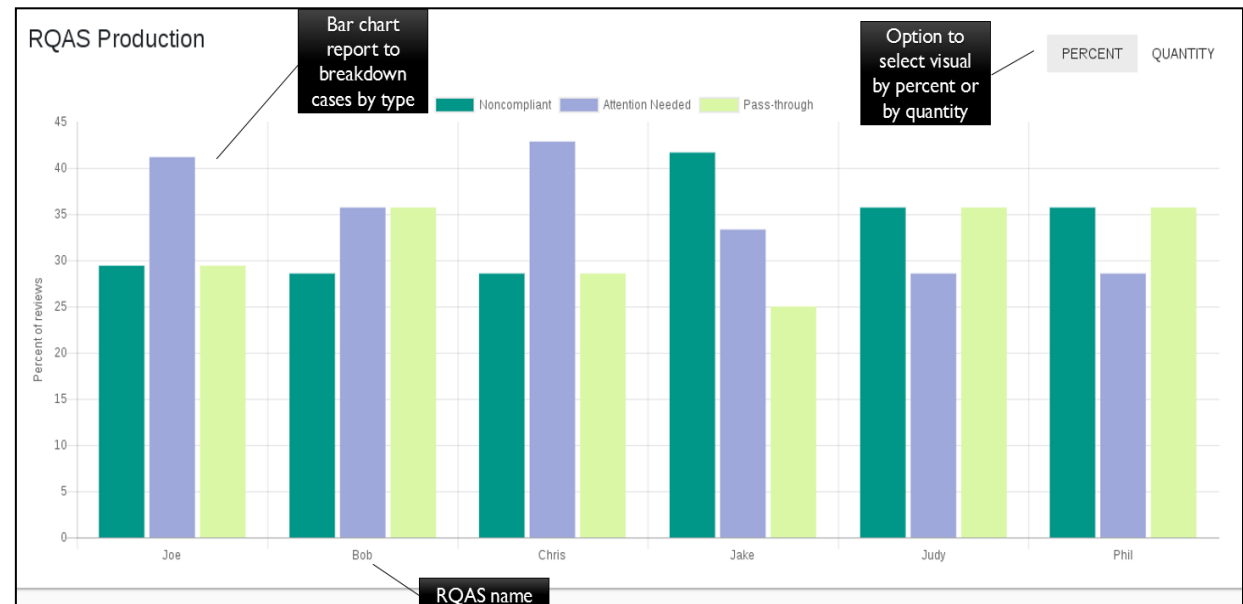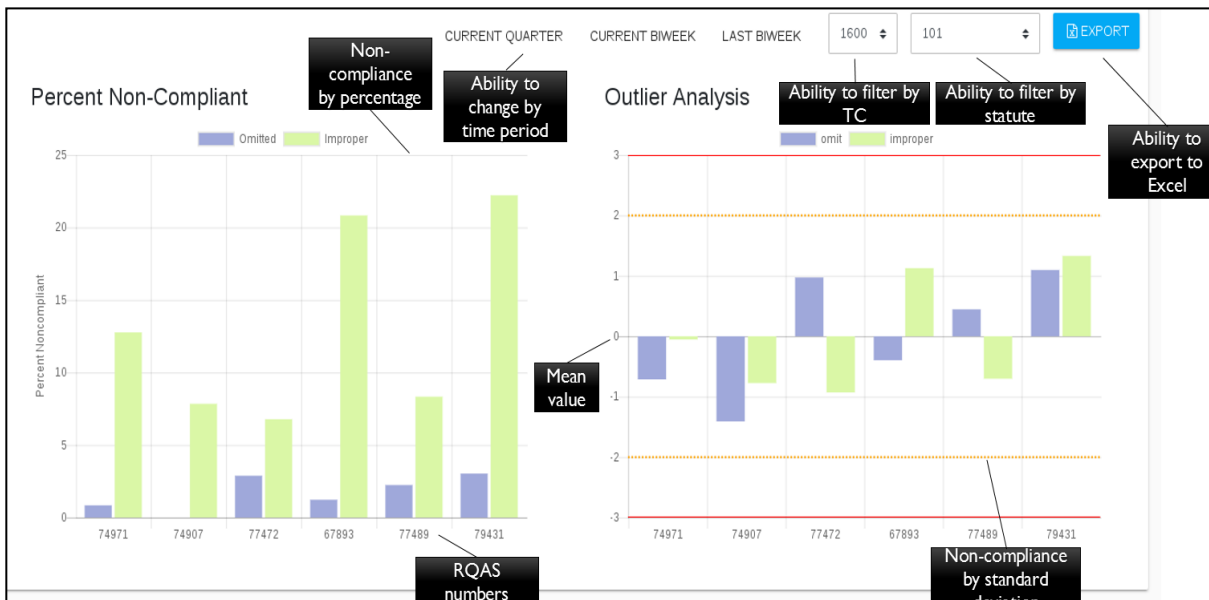

Figure 10: RQAS Production Data (2)

Figure 11: RQAS Consistency Data Graphs

Noncompliance Issues Raised Report

Quality Leads requested a table to assist them in tracking the whereabouts of an alleged non-compliance after it has left their jurisdiction. This table can be seen in Figure 12. Currently, after an alleged noncompliance is sent to the TCs the QLs lose track of the report for a while. This makes it very difficult to keep a running tally and up to date data sheet about each of their RQAS' alleged noncompliance reports issued, and how many or what percentage make it to each possible stage.

In order to help gather all this information in one place, we recommend that a Disposition of Reviews table is implemented into the IQS System. This table, broken down by RQAS

As seen in Figure 11, Option 2 is a vertical clustered bar chart. Although this graph is similar to Option 1, the information is displayed in terms of standard deviation instead of percentages. This option gives the QL the ability to see how far each RQAS varies from the mean. The "3" value on the chart either in the negative or positive direction indicates a potential problem for an RQAS, because they are 3 standard deviations from the mean, and would hopefully begin a conversation with their manager. The closer a RQAS is to "0" the closer to the average they are. [Note: (1) Comparisons are only valuable within each Technology Center, due to difference of subjects and cases reviewed. (2) Having the option to sort by different time periods allows the QL to see improvement or worsening over time.]

Figure 12: Noncompliance Issues Table

name, would have the different possible stages of an alleged noncompliance along the top. In each possible stage there would be two columns. (1) Column one would give the amount of alleged noncompliance reports that made it to that stage and (2) column two would calculate the percentage from the previous stage that have made it to that category (*see Design Specifications for more information*). In addition to having this broken down by RQAS, we recommend that an additional "total" column is included at the bottom to give the QL an overall summary of the entire TC's alleged noncompliance reports.

Finally, by giving QLs the ability to remove unwanted columns, the ability to view by count, percentages or both, and the ability to export the data table to excel, we are able to provide multiple viewing options to the QLs to further analyze the data.

Timeliness (Tickler Report) Tracker

Similar to the Distribution of Review table (*see the prior Noncompliance Raised Report)*, Quality Leads would like the ability to better monitor the spread of alleged non-compliances and to know how long the reports have been sitting in a particular category. By having this information, the QLs would be able to better manage the backlog of cases in each stage.

We propose to display data in the requested categories (see Figure 13 for more information) in the form of multiple cards. Each card has two major purposes. (1) The large total number on the card indicates the total number

of reports in the indicated category. (2) The small colored dots on the top of the card indicate how long each of the reports have been in this particular category. For example, the number red dot indicates that the number of reports that have been sitting in the category for 6+ days and the other colors indicate a lesser holding day value. [Note: Due to familiarity with the SPE dashboard and the importance of longer held alleged non-compliances, we recommend that the order of dots is red, orange, yellow, and then green from right to left.]

If a QL wants to see the detailed cases in the card, they have the option to click on the card to reveal the list of the cases – similar to the docket already in IQS. This would allow

them to view more information than just the count.

QL Overall Goal Plan

As discussed in the *Process Indicators* section of the Background, the OPQA is implementing a new goal plan for its Quality Leads in the upcoming Fiscal Year. Key elements of this plan include tracking their TC's overall production, maintaining certain timeliness metrics of first actions, and completing random reviews on their RQAS. Due to this being a new program, there is no current dashboard that puts all of this information in one place. We recommend that this space is created for easy periodic checkup.

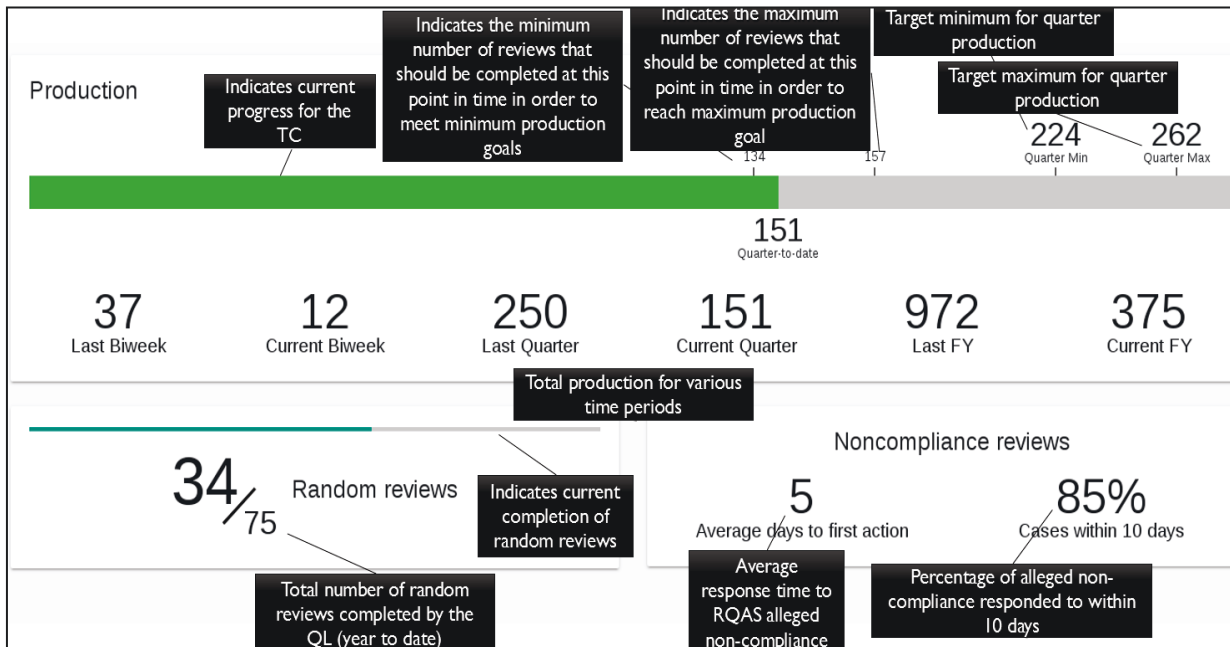*Figure 13: Timeliness (Tickler) Tracker*

Figure 14: QL Overall Goal Plan Dashboard

Review Quality Assurance Specialist (RQAS) Dashboard

After six meetings with RQAS for our needs assessment and four meetings for feedback, we concluded that the RQAS wanted four main reports and four major features added into IQS. These can be seen in Figure 15.

Overall, their need for consistency, production, and timeliness of alleged non-compliances was very similar to the Quality Leads'. The main differences lay in the levels of privacy created and the amount of information that the RQAS need to access. For example, RQAS will be able to see all visualizations, but will only be able to see their own name and not the names of their colleagues. RQAS also wanted to be able to monitor how they spend their hours to help ensure that they are spending most of their time
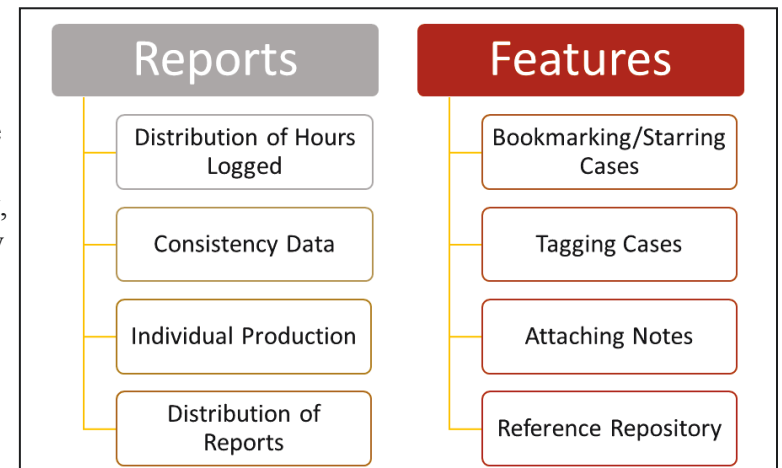
As discussed previously in *RQAS Production Data*, we recommend displaying an overall progress bar for the entire TC. This bar shows the total current completed amount of MRF reviews in comparison to the TC's overall quarterly objective, and the range that the TC should currently be in between to remain on pace for success. Accompanying this progress bar we suggest that certain number values are emphasized for a quicker view. As seen in Figure 14, the numbers include metrics such as total production of the last bi-week, current bi-week total production, and previous quarter production, amongst others.

In addition to emphasizing production statistics, we also propose this approach be implemented in the timeliness sector of the goal plan dashboard. We recommend that there is a number displaying the average amount of days until the QL makes the First Office Action, and the amount of those Office Actions that occur within the first ten days. Finally, we recommend a progress bar to show the QL how many of the yearly reviews he has individually completed.

Figure 15: Breakdown of RQAS Needs

Figure 16: Distribution of Hours Logged

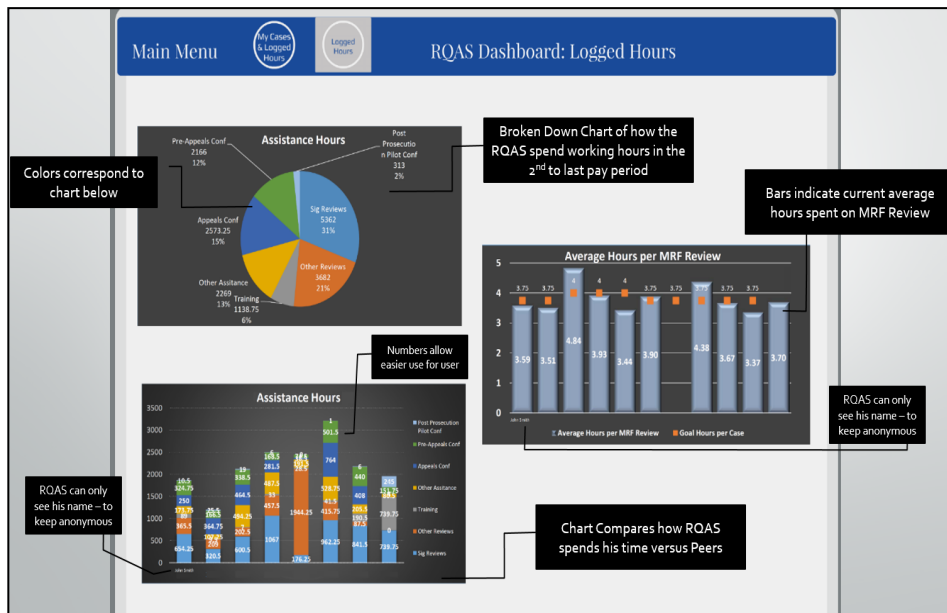*Figure 17: Consistency Data (1)*

working on the more important things. The most surprising need that we uncovered involved increasing functionality within IQS. Accordingly, we recommend developing "Features", such as tagging and bookmarking. Another overarching need of the RQAS was the ability to search more thoroughly in IQS.

Distribution of Hours Logged

RQAS expressed the desire to see a breakdown of their logged hours. Currently, RQAS do not have a cumulative record of their hours after submitting them into WebTA (a government hour-logging platform). The data is given to the OPQA, but not often referenced.

We recommend that the RQAS are shown this information in three forms. They requested the ability to see time spent as an individual as well as in comparison with others.

For the individual data visualization, we recommend that the above information is portrayed in a pie chart by major category (Figure 16). This pie chart would give the employee an overview of the way that he spent his time during that last available displayable pay period.

The comparison visualization would use stacked bar charts. The purpose of this visualization would be to demonstrate hours the RQAS spent on certain tasks in comparison to their peers. This information would be cumulative based upon the most recent information provided from WebTA for the current fiscal year. This would help employees regulate how
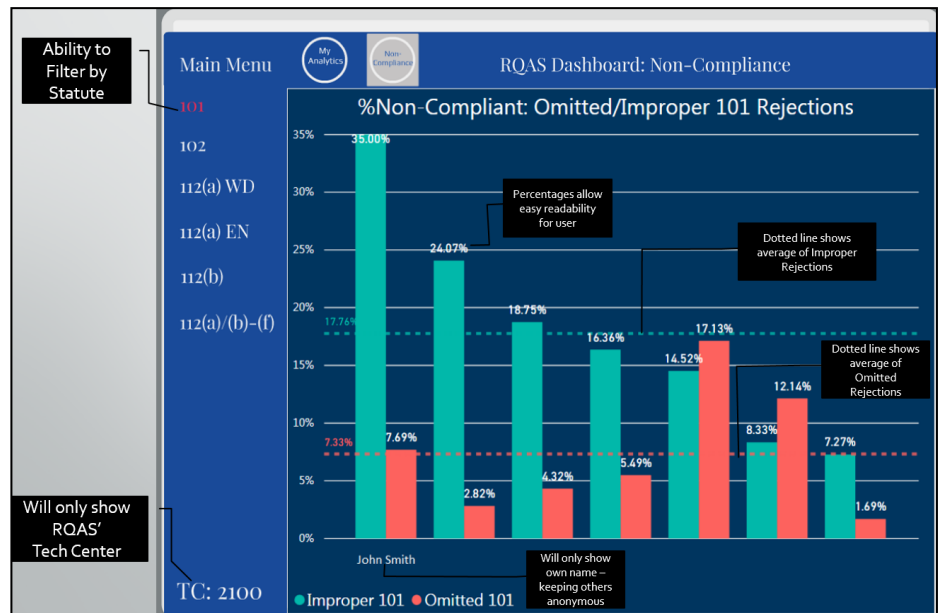
much time they are spending on specific tasks throughout the year.

Finally, due to the fact that the major purpose of the RQAS is to complete random MRF reviews, we recommend that there should be some way for the RQAS to see the average time that is spent per MRF review. We suggest that this is displayed in a bar graph. This would, yet again, be set up so that the RQAS only sees his own name along with his fellow RQAS in his TC's data. This chart would have a line indicating the averages of the RQAS in that TC along with the individual's average year-to-date. [Note: All of these data would be provided on a two week delay due to WebTA restrictions that are out of our control.]
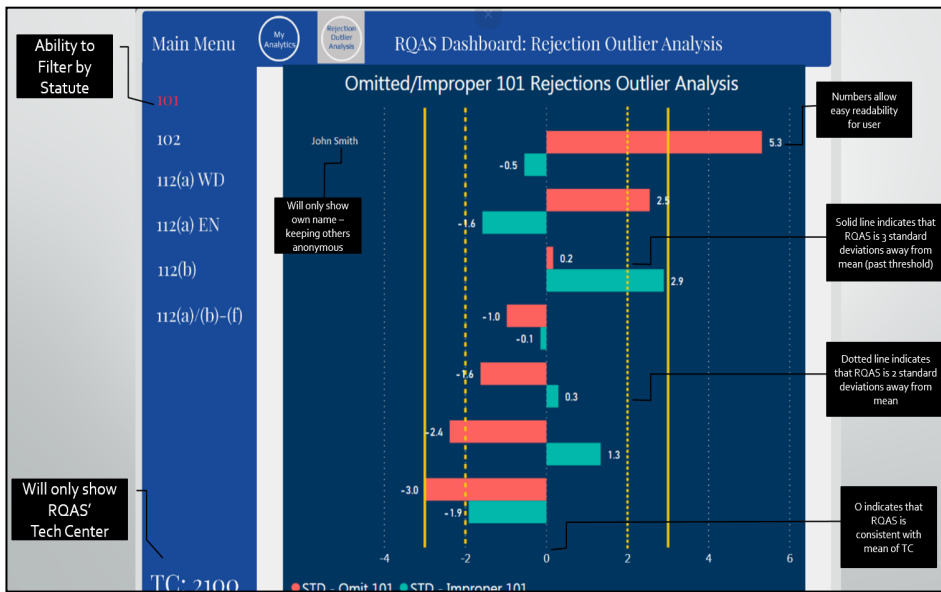
Figure 18: Consistency Data (2)

Consistency Data

Currently there is no way for RQAS to compare themselves to their TC peers in terms of production statistics. Multiple RQAS expressed interest in seeing their alleged non-compliances. They did not just want to know how they differed from the average, but how their peers differ from the average as well. For these reasons, we propose displaying the comparative data in one or two charted forms.

As seen in Figure 17, Option 1 is a vertical clustered bar graph created using percentage values. The individual RQAS' name would be displayed with his bars but his or her peers would remain anonymous. The total percentages of non-compliances would be broken down by statute, and furthermore by Improper vs. Omitted (when applicable).

We also recommend a few additional features to ease the readability and productivity of this graph. In order for the RQAS to see how they compare to the average of both Improper and Omitted rejections in the specified statute, we recommend inserting a dotted line at the average percentage value. This, once again, gives a visual representation of the individual RQAS compared to their peers.

As seen in Figure 18, Option 2 is a horizontal clustered bar chart. Although this graph is similar to Option 1, the information is displayed in terms of standard deviation instead of percentages. This option gives the RQAS the ability to see how far they deviate from the mean. The "3" value on the chart either in the negative or positive direction indicates a potential problem for the RQAS and at this point it may be a good idea for them to speak with their respective QL. [Note: (1) Comparisons are only valuable within the RQAS' Technology Center, due to differences in subjects and cases reviewed. (2) We decided that providing the absolute value of the standard deviation for the RQAS was not important based on feedback. A couple RQAS mentioned that most of them would already know which way they fell on the subject, so hiding negative or positive would not matter.]

Individual Production

RQAS expressed the desire to visualize their individual production statistics. Currently there is not a way to see their production numbers purely by decision or statute. A few RQAS have even developed their own spreadsheets and documents to assist them with this task.

We recommend implementing a similar model into IQS for all RQAS to use and access. The page would be divided into individual pie charts by statute. For example, 102 rejections, 103 rejections, 112(a), etc (see Figure 19 for more details). The total value for the chart would be represented by the number of total reviews that have been completed by the RQAS and that are applicable for the particular statute. The pie chart would be divided into the three decision categories (Pass-through, For-Consideration and Non-Compliant) based on the number of rulings per category.

This visualization would allow RQAS to self-check their output and ensure that they are not over or under critical in regards to particular statutes.

Distribution of Reports

RQAS expressed the desire to be able to follow their alleged non-compliance cases after
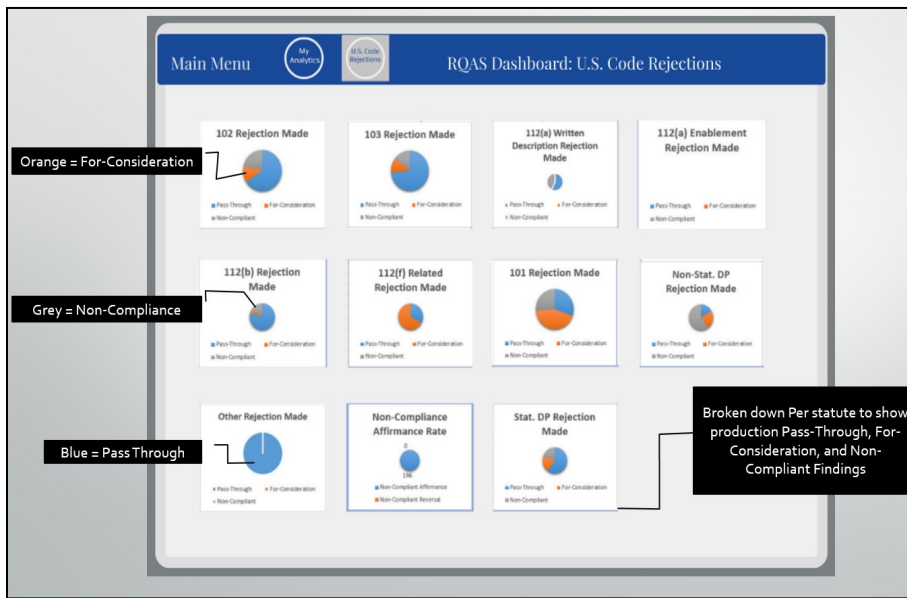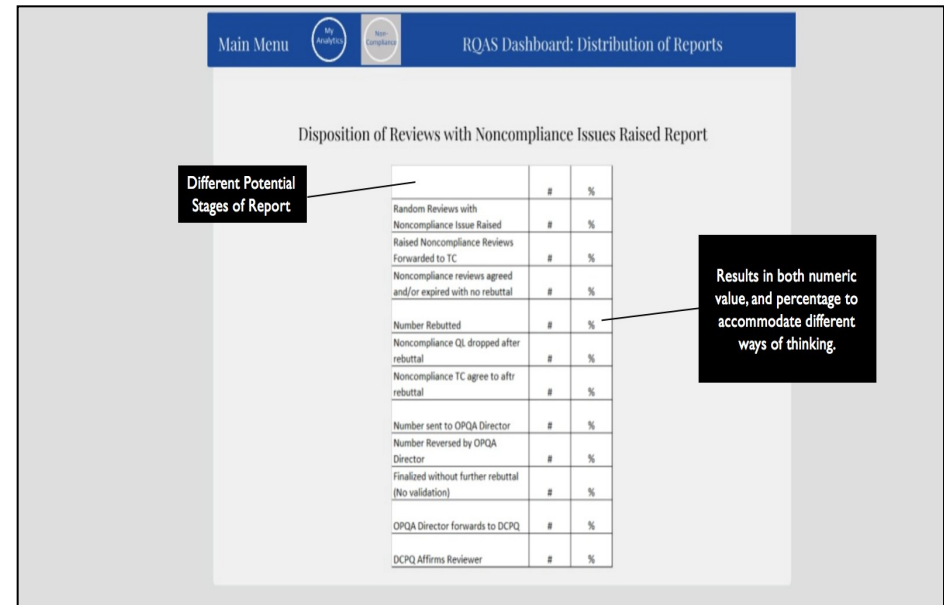
Figure 19: Individual Production

Figure 20: Distribution of Reports

the reviews have left their dockets. Overall, RQAS have difficulties knowing the results of these reports unless they search for the information. They also do not know counts unless they manually manage all the results.

We propose that the RQAS have access to a feature that is similar to the Quality Leads Disposition of Reviews table (Figure 12). This table (Figure 20) would include the various possible locations of the alleged non-compliance on the vertical axis and a two-block format on the horizontal access. The two blocks would give (a) the count of reports in that category and (b) the percentage in this category compared to the last sub-category that the report was placed into. See *Design Specifications* for more detail.

By knowing these statistics and having

them easily accessible, RQAS would be able to track the outcomes of their alleged non-compliances raised and either gain and maintain confidence or know where they can improve.

Bookmarks/Starring Cases

RQAS would like an easier way to save certain cases in their dockets. We recommend entering some kind of "starring" option in IQS to allow more customizability in the organization and retrieval of cases that RQAS may want to reference at a later time.

Tagging Cases

RQAS expressed the need to categorize cases within their own dockets. By installing a

"tagging" feature into a case, RQAS would have ability to further classify and categorize cases for later referencing. This tagging feature would resemble a "hashtag" that is currently used in social media. A search or filtering option would also be beneficial to assist RQAS in locating these tags easily. [Note: Tagging would be private unless shared to Repository.]

Attaching Notes to Cases

Currently RQAS do not have a place to put notes within IQS. Many RQAS resort to writing their case notes on paper, typing their notes on a word processor, or emailing notes to their inboxes. By having the ability to place personal notes in IQS (with a search ability option), RQAS would have the ability to easily filter
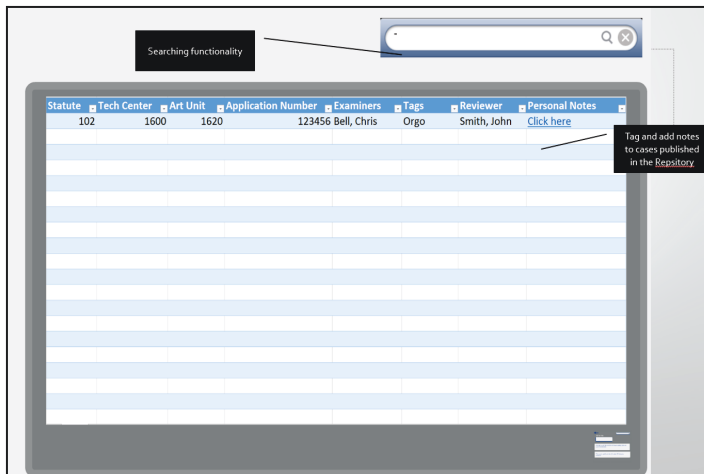
Figure 21: Reference Repository

through these notes.

The "Notes Link" would take the RQAS to a different window. Here the note page would be set up in a series of cards. RQAS would have the ability to make notes on the cases to their own discretion. Notes would have a timestamp, and a delete button. The notes should be searchable as well. [Note: The notes should be private to their QL and peers – unless shared in the Repository (see below). However, because of federal regulations it is important that the RQAS is aware that any written notes would be publicly accessible under federal guidelines such as FOIA (Freedom of Information Act) requests.

Reference Repository

The purpose of having a central repository would be for RQAS to share examples with other RQAS. When an RQAS finds an exemplary case, they have the option to forward the case to this new area in IQS. This area would list cases, organized by Technology Center and statute and filterable by tags. This docket would work the same as the update docket with notes and tags. [Notes: (1) If a case is forwarded to the repository everything would become public (including tags and notes). (2) In order to maintain authenticity of the repository it may beneficial to have the sent cases verified by the corresponding QL before being sent to the repository.]

Patent Operations Dashboard

The Patent Operations' needs were quite different from both the Quality Leads' and the RQAS'. The main reason for this is due to the fact that, unlike the OPQA, IQS is not the primary data application used by the Patent Ops team. The overall idea of the Integrated Quality System was to implement the reviews from both the OPQA and the SPEs into one uniform system. This is difficult to do because the Patent Operations Team utilizes a Quality Tracker form more frequently than the MRF form (which is what the OPQA uses). This difference in forms, and of course difference in processes, has not made the integration into one system the easiest. From our observations, it appears that IQS was designed with OPQA as the primary priority and the Patent Operations Team as an added bonus. Currently, SPEs have reported that they only log into the IQS system a handful of times per week due to its lack of easy navigation, and its slow loading speeds. After speaking with multiple Directors, MQAS, and SPEs across several disciplines we have developed a list of recommendations of data dashboards and functionality improvements that will continue to move IQS into a truly integrated system for all reviewing purposes. There are visual aids accompanying each of the categories mentioned in Figure 22. At the end of these recommendations is an additional list of suggestions we gathered during our needs assessment which do not have corresponding visual examples.

Figure 22: Patent Ops Dashboard Breakdown

Figure 23: Ability to Edit Tabs

Figure 24: Patent Ops Timeliness Tracker
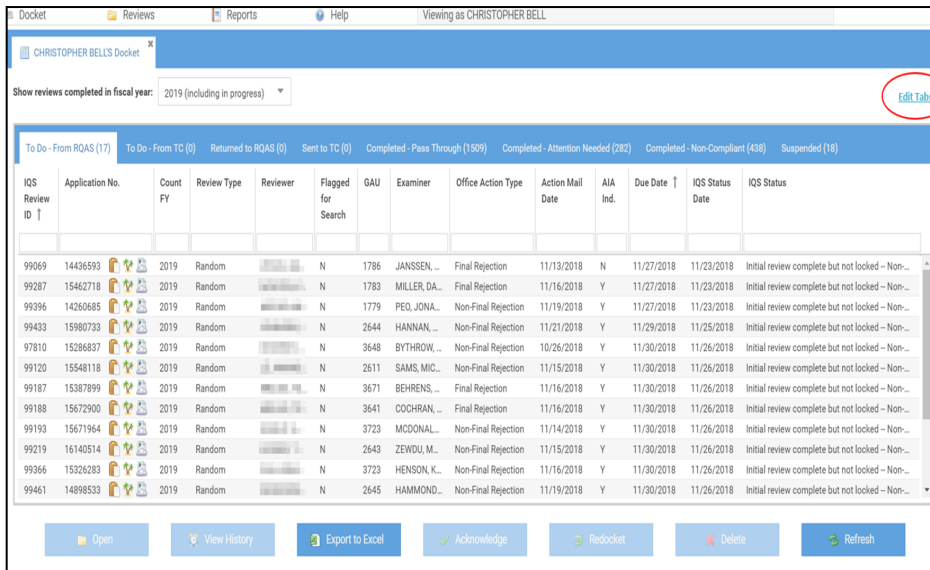
Ability to Edit Tabs

The Patent Operations Team does not have the customizability that allows them to alter the viewing tabs in their individual docket. We recommend adding the ability to drag and move tabs around, delete tabs, or insert tabs back in when needed. By allowing the MQAS, SPEs, and Directors this customizability, they can have easier access to the information that they want to see and use most often. This would improve overall user experience.

Color Coding Time Remaining

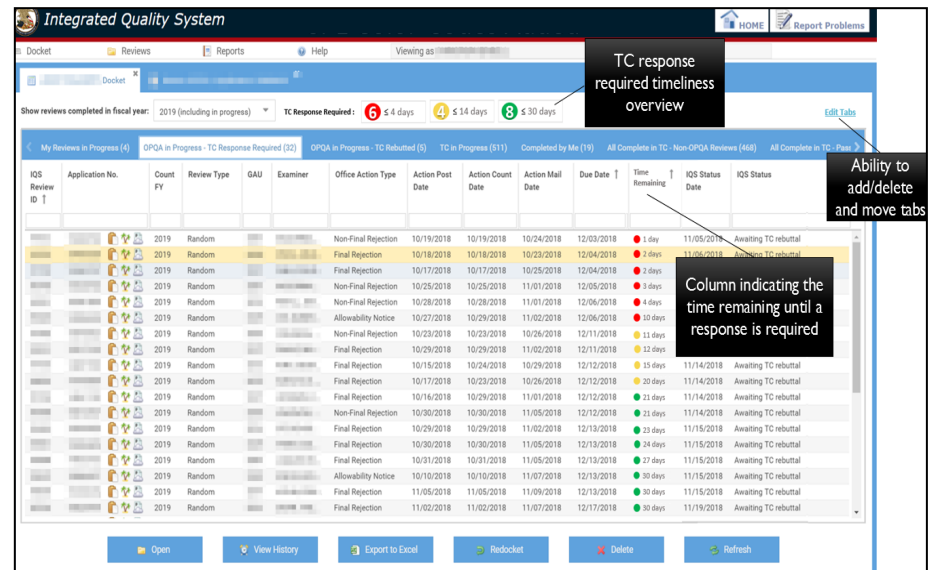A major reason that the Patent Operations Team utilizes the IQS system is to view alleged noncompliance reports and attention needed cases from the OPQA. Currently on the Patent Operations' dockets there is no indicator to assist their employees on the timeline remaining to refute the cases back to the OPQA – there is simply only a due date. We recommend inserting a system similar to the *Timeliness Tracker* in the Quality Leads Recommendations. Inserting color coded dots (as seen above) can assist the TC in ensuring that the cases do not miss their deadline if they would like to challenge the decision. This is very important because if a TC misses this deadline, the alleged noncompliance is automatically charged to the TC and the TC loses its right to argue back. In conclusion, ensuring that the Patent Operations Team is aware of these deadlines will improve the organization of their TC as whole, along with improve the accuracy of the alleged noncompliance reports by ensuring mistakes are only upheld when they are indeed correct.

Ease of Transferring MRF Information to Examiners

One of the most expressed issues that we gathered about IQS from the Patent Operations Team was the inability to efficiently get MRF information out of IQS for emailing or printing purposes. This was specifically for the SPEs trying to send feedback from the OPQA to their respective patent examiners. Currently, each section must be tediously copied and pasted individually because there is no way to do it efficiently, with the ability to edit the text in email.
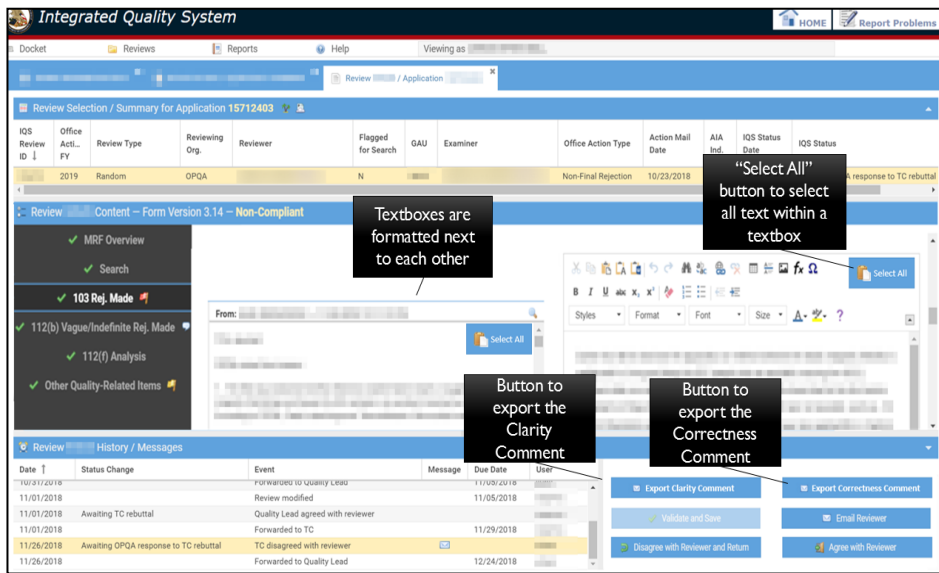
Figure 25: Compare Rebuttal to Original MRF

the textboxes to be next to each other. This is displayed in Figure 25.

Ability to Link Original Case and Art to Review Application

Every time that a review is made either using the MRF or the Quality Tracker forms, the results of that form are put in IQS. When an employee on either the Patent Operations or on the OPQA side wants to view this review, they can only see the completed form and not the application itself. In order to see the Patent Application, the employee must log onto two separate systems and access both the artwork and the application individually. To increase efficiency, we recommend altering the function of the current DAV link on the docket to bring the user to the specific application with the art work itself rather than a searchable area. This is currently on a program known as PE2E. Integrating the two would allow better reference to the original applications and encourage more cross reference between the feedback and the original application documentation to continue and improve consistency throughout the TC.

This is very evident when the text is long or if there are multiple correctness and clarity issues within the same case. To ease this problem, we recommend adding the functionality of exporting the commentary into an email or a pdf for easy sending and printing. We also recommend implementing a hover over effect to assist with explaining the clarity of each button to its user.

Difficult to Compare Rebuttal to Original MRF

Another pain point that was expressed in our Patent Operations meetings was the inability to easily compare the rebuttal text with the original error text. To make the two easier to compare we simply recommend reformatting

Giving the Director an Overview of SPE Production Reports

After interviewing a majority of the Directors in their respective TCs we came to the realization that the Directors need a dashboard report page to assist them in keeping track of the production and timeliness for every SPE within their work group. By being able to monitor the amount of alleged noncompliance reports sitting in each SPE's docket and to see the reviews conducted by each SPE, the Director can easily see a graphic overview of the reviews occurring in each Art Unit.

On this page we recommend giving the Directors access to a table stating the name of each SPE that they oversee along with the total count of alleged non-compliance reports in each day category (like the *Timeliness Reports* for the QLs and the *Timeliness Tracker* for the Patent Ops) to ensure that each Art Unit is on top of the reports and is not letting any run beyond the time unit. The other major element on this page is a multiple user line graph to assist the Director on seeing the amount of reviews (typically Quality Tracker Reviews) that each SPE is completing and the time in which they are completing them. This helps the Director maintain the confidence that the spot-checking is occurring constantly throughout time and that it is not all being jammed in the beginning or end of the reviewing period. Figure 26 shows this information in terms of quarters, but in the implemented version, the Directors should have the ability to change the time period into any range in which he or she finds fit. This is also
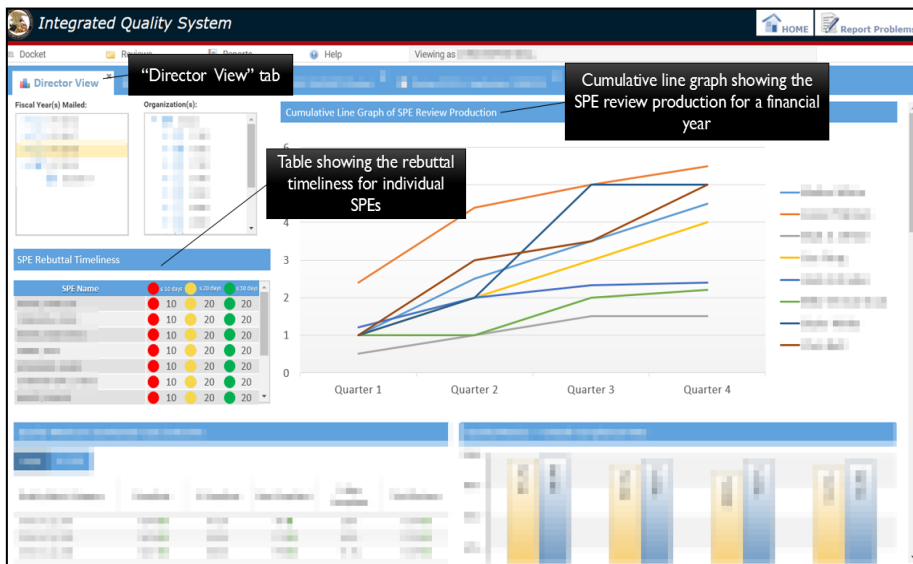
Figure 26: Overview of SPE Production Reports

Art Unit	# Reviews in SMD	# Clear Errors	# Errors - Coaching/ Mentoring	# Actions Indicia of Rating
2411	128	70	0	91
2412	96	0	0	94
2413	41	0	5	103
2414	181	130	44	43
2415	47	0	3	54
2416	79	0	13	72
2421	176	21	35	138
2422	175	12	10	107
2423	288	23	205	124
2424	349	145	245	34
2425	269	59	72	230
2426	246	104	28	152
2427	156	0	2	4
2431	185	51	23	131
2433	195	4	44	152
2434	198	85	16	159
2435	159	12	3	142
2436	96	16	40	62
2437	283	114	124	95
2438	222	72	21	170
2439	122	40	0	90
2441	151	61	18	100

Figure 27: Quality Tracker Entries per Art Unit

true for the SPEs / work groups / Art Units. It could also be broken down into the amount of reviews completed on each patent examiner itself in this line graph.

In conclusion, implementing this viewable report for Directors would help the Directors see a snapshot of the amount of reviews being done in each Art Unit over time and to see the amount of alleged noncompliance reports remaining in each Art Unit. This will ultimately help Directors better manage his or her SPEs.

Knowing the Amount of Quality Tracker Errors per Art Unit and Examiner

An important job of a TC's Directors is to monitor the amount of errors occurring within their Art Units and doing what they can to help limit these errors. During our interviews, a requested report that was brought to our attention is a report that had been available in the past, but it not currently available within IQS. This report (as displayed in Figure 28) would be broken down into Art Units and then further into Patent Examiners. The view would assist Directors (and then SPEs) to see an updated version of the amount of errors brought upon each examiner in the given time period.

The table broken down by Art Unit would include the number of total reviews used, the total number of clear errors found in the reviews, the number of errors that were due to coaching or mentoring issues, and number of actions that were indicia of rating. Another interesting fea-ture of these tables would be the addition of a horizontal bar to assist the user to visualize the amount in each said category in comparison to the others. This would be just a feature to help spark interest because the more amount of reviews the more errors will be found so this visualization cannot always be taken completely factual.

After clicking on a particular Art Unit, we suggest that the user is taken to a table that is broken down to the individual reviewers within each Art Unit. This would show even more in-depth information about the reviewing of the Art Unit. As seen in Figure 29, columns for this report could include the total number of reviews per examiner, the amount of clear errors, and

Figure 28: Quality Tracker Entries per Examiner

Figure 29: Data to Assist Directors in Assessing SPEs

the amount of errors that apply to certain categories. This glance at each examiner allows SPEs, MQAS, and Directors the ability to see a breakdown of errors occurring throughout the TC.

Data to Assist Directors in Assessing SPEs

As stated previously, the Patent Operations Team functions differently from the OPQA so it only makes sense that they track processes differently. In one of our meetings, the Director provided us with some useful tables that were made by their individual TC to assist in tracking these metrics in one place. Referencing these tables, we recommend that graphs are created in the prior layout of Figures 28 and 29.

We recommend that these threes table are made with the SPE names and Art Unit in two columns along with multiple values throughout. All this information would be information from the selected time period's QIR (Quality Index Report) data. The red part of Figure 29 would represent information about the allowance rate. The orange categories of that figure contains data metrics based around the reopening of cases. Finally, the blue table headings include information about the TC's rework. Havi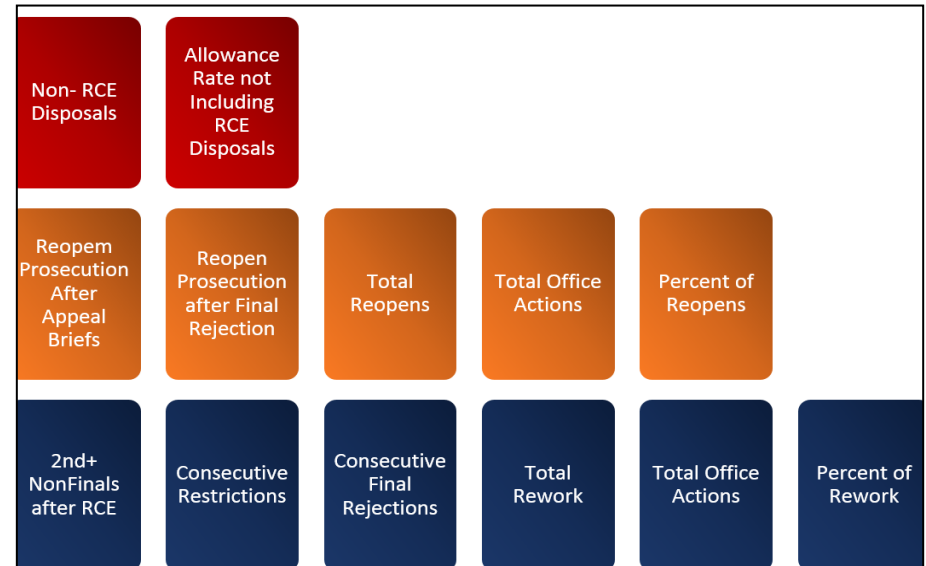ng allowance, reopen, and rework data easily availa-ble to the Directors will help them continue to internally monitor and assist their respective Art Units.

Implementation of Current Status in TC

After talking with the Patent Ops, it came to our attention that the reviewing process after it leaves each employees hands is not always the most transparent. To assist with this problem, we recommend ensuring that there is an "IQS Current Status" column on every review in their docket. This helps limit the amount of time and effort that is used by Patent Ops employees to track down the status of a particular case. Adding the column also gives the filtering ability to see cases in a specific status only.
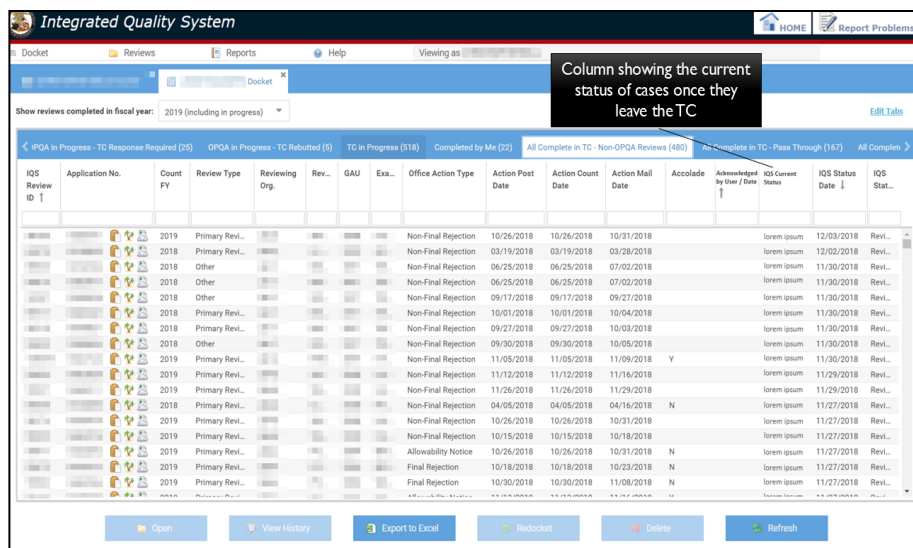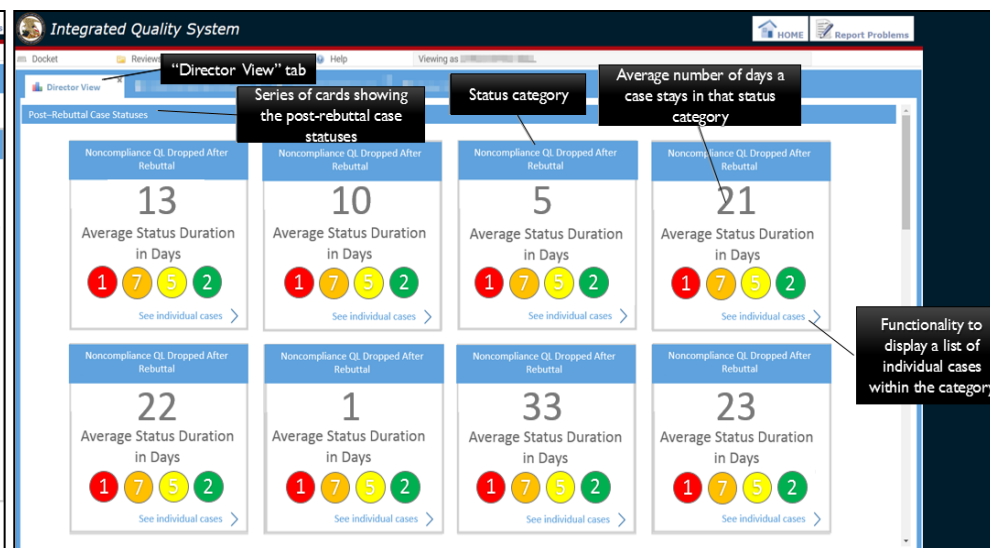
Figure 30: Implementation of current TC Status

Figure 31: Post Rebuttal Cases — Tickler Report

Post Rebuttal Case Statutes – Tickler Report

As mentioned previously, a big issue with the Patent Operations interface is the inability to track cases after it leaves their respective TC. This is both in terms of timeliness of the report and the amount of cases that remain in each additional stage. To assist Directors in maintaining control of all the outgoing rebuttals back to the OPQA, we suggest a tickler report (as seen in Figure 31).

On the main screen each post-TC category would be displayed. The number in the center of each card displays the average amount of time spent in that category for each case. The color display of green, yellow, or red determines the severity of the wait time (in days) for each category [We are not positive about thresholds]. The numbers on the lower part of each card shows the number of cases that are currently held in that category, and by clicking the corresponding arrow a docket view of these cases would pop up for further details. This docket would include time dots, similar to what is displayed in Figure 24 in *Patent Operation's Timeliness Tracker*. This recommendation brings in organization and overview of post TC case status but also allows the user to interact with the interface to gain more details when needed.

Addition of Timeline into History View

Currently, the history view of a case is simply displayed in a table. This table makes it difficult to visualize the lifetime of a case. The idea was expressed by a couple of the Directors to implement a visual representation of this information for a quick glance.

To get to our recommended timeline the user would click on the "View History" tab, which is at the bottom of the docket page when a case is selected with the user's mouse. The screen that appears would still contain the current table, but it would be moved down on the display tab. The visual timeline would be the major portion of the interface. As seen in Figure 32, this timeline would have category names for each case with the corresponding dates. For more information about that individual step, the user would need to utilize the table. The ideology of the timeline is to have the timeline spacing based upon time allotted between each status change. In conclusion, this timeline enhanc-
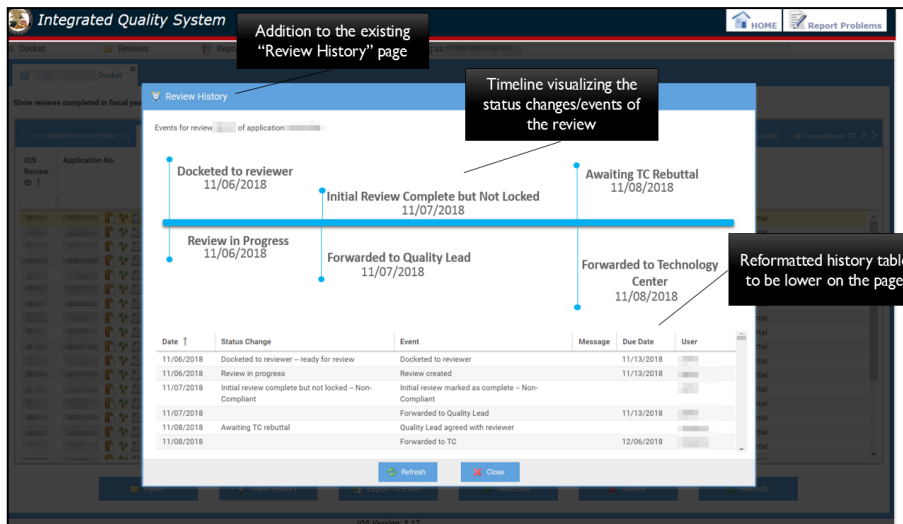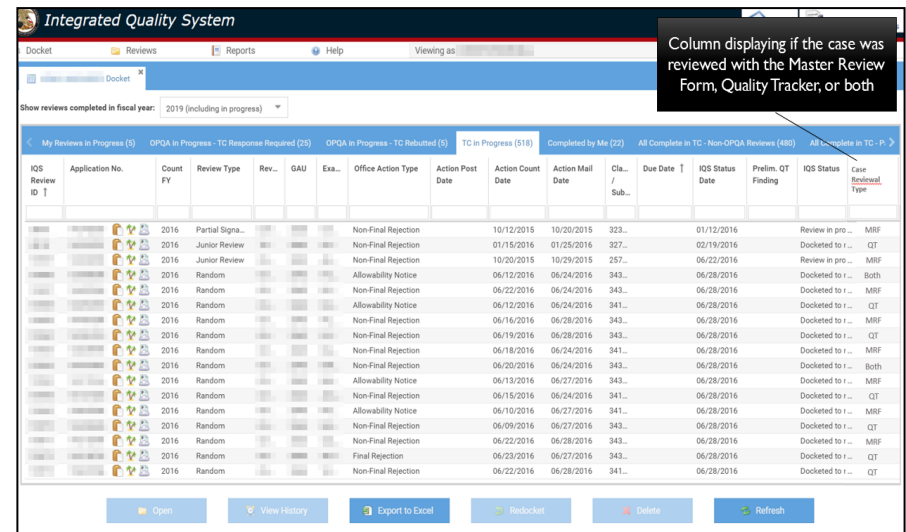
Figure 32: Addition of Timeline into History View

Figure 33: MRF vs Quality Tracker Column

es the user experience by visualizing the table data is an easy timeline visual.

Easily Displaying Master Review Form vs. Quality Tracker

Since SPEs utilize the Quality Tracker from for their examiners versus the MRF form of the OPQA, the reviews of each case listed in the Patent Operation employee's dashboard corresponds to one of the two categories. This difference is not always obvious to the user. For this reason, we recommend implementing a column on already existing dockets to assist users in easily deciphering the two. An example of this suggestion can be seen in Figure 33.

Error Outlier and Consistency Information

An overarching goal of the USPTO is to maintain the utmost level of consistency throughout its Tech Centers. For the Patent Operations Team they would like to minimize the amount of errors found overall, but certainly to ensure that one particular Art Unit is not making drastically mores errors than its counter parts within its workgroup and within its TC as a whole.

Our recommendation is to create a standard deviation chart that would display each Art Unit and the count of errors that have been found in its relation to the overall average of the work group or the TC (depending on the selected time period). This graph is very similar to the two previously described in the *RQAS' Con-*

sistency Data Dashboard and the *Quality Lead's RQAS Consistency Data Dashboard*. The only major difference is that lower than average would be better than above the average or even average itself in this category. An overview of this graph can be seen in Figure 35. This consistency data would mainly be for the Directors, since SPEs could easily manipulate this data as they conduct most of the reviews for his or her Art Unit.

Making Statute Non-Compliance More Specific

A major concern that was addressed within each user group was the inability to gather specific data on IQS from the MRF. Within each statute there is a multitude of mistakes that could have been made. Currently, in order to
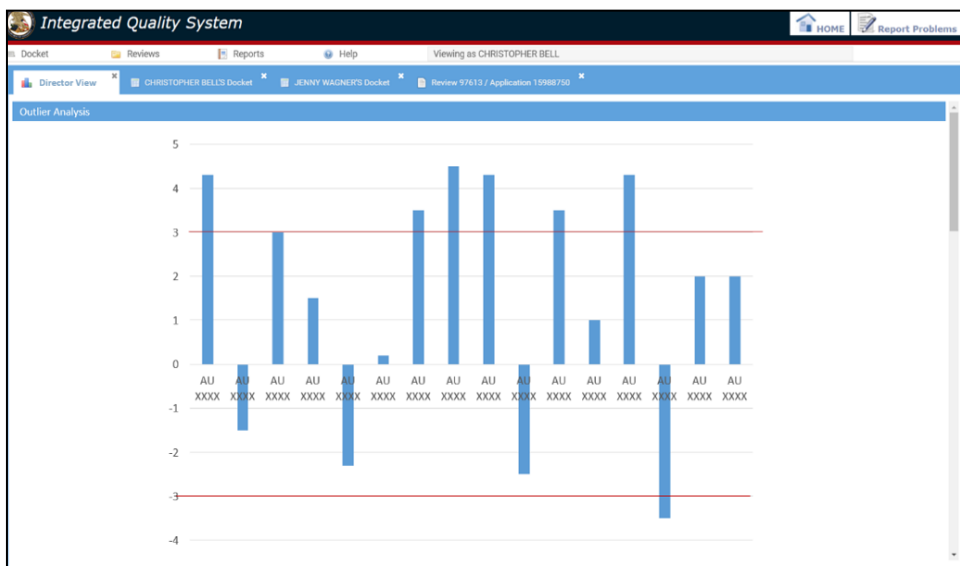
Figure 34: Outlier Analysis by Art Unit

see the number of each mistake made the user must individually click on each reviews, and then each "flagged" statute. This is a long, drawn out process and it hinders the ability to easily find trends, as well as makes the mid and end year filling out of reports more time consuming.

In order to track current trends, we recommend the ability to dive deeper on the information already on the Quality Dashboard in IQS. We propose that clicking on a certain rejection type (ex. 35 U.S.C. § 102) would bring the employee into a further breakdown.

Along with this breakdown, the ability to access and print a PDF file of every case within a given time period would be beneficial. This way the employee can have all of the reviews (in their full form) in one place. This would expedite the reporting process by minimizing the amount of clicking between each statute per review. If this were to be made a possibility we would also recommend that the percentage of each sub-category of the MRF form would be included. In addition, it was expressed that SPEs would also like to know how many reviews were completed by RQAS that resulted as a pass through. This way the SPE is aware of the ratio of mistakes found from the overall total sampled. We believe that this would also serve of interest to the Directors and the MQAS as well.

Additional Improvements and Features

Although we were able to mock up some of the major suggestions provided to us by multiple TCs, there were a lot of suggestions that were either non-displayable or suggestions that were mentioned less frequently than others during interviews. These included elements such as improving loading speeds, implementing email notifications, and improving linkage between IQS and OC. More recommended changes are included in Table 2. For a full description of these changes please consult our separate *Design Specifications* document.

About the Specifications

Supplementary to the interview results and the information and images provided above, we created a set of technical guidelines to help further describe our recommendations. This document, known as *Design Specifications*, provides the USPTO with additional information to guide the implementation of these recommendations in the future.

The format of each *Design Specification* varies by the assessed user group. Specifications for the Quality Leads contain the technicalities of how to create/calculate the recommended graphs and tables along with each feature's set purpose. The QL specs also specify the page to which each feature should be added, the design of the feature, and the order on the page. Finally, the QL Dashboard discusses filtering and other customization features requested by the QLs during our initial and follow-up interviews. Overall, the Quality Leads *Design Specifications* remained very uniform and specific throughout.

The format of the RQAS Specifications was similar to that of the QL's. The first half of the RQAS Specifications included the same Page, Purpose, and Design layout as before. The difference came in the second half of the RQAS

section due to the request of functionality improvements in comparison to new data being displayed. This second half of the RQAS Specifications, labeled *RQAS Other Requested Features*, simply states each feature that we recommend and a brief few sentences stating the purpose of this new feature. We did not provide detailed specifications in this situation because we believed it was best to leave the installation up to the individual.

On the Patent Operations Specifications, the format is drastically different. Due to the many requests for improved features and links between different data bases and IQS, and our limited time to work with this user group. These specifications are less detailed than the OPQA recommendations. The approach we took to these specifications was straight forward. Each recommendation is grouped into three major groups by level of importance (high, moderate and low). For each recommendation, we describe the purpose and overarching topic. The information supporting the recommendation will help the Patent Office begin to implement the most important changes within IQS and continue the discussion with Patent Ops.

Although the format of the *Design Specifications* varies per user group, the overarching goal remains the same. The written design specifications allow a deeper dive into the purpose of each recommendation with the hope to improve understanding and execution of these recommendations.

Table 2: Extra Design Specs Features

Improve Loading Speeds	Improve Automatic Linkage between IQS and OC
Make the "TC in Progress" Tab descending by IQS Status Date	Close Overdue Examiner Alleged Errors automatically
Create better copy and pasting functionality	Make it easier to gather a long report of all errors for performance reviews
Create a print in PDF view	Create a function to automatically list potential examinations to review
Create a way to Bulk Export Reviews to Excel	Change format of Error maintained email to differ error charged email
Implement Email Warnings	Implement SPE and Patent Examiner Communication Mechanism
Display Paygrade Level of Examiners	Receive an email when events happen on post-case rebuttal
See pass through information	Add Custom Time Period Options to all applicable screens.

Recommendations and Conclusions

The *Integrated Quality System's* (IQS) impressive usability for such a young web application is a feat within itself, but in order to keep it as useful as it can be, the USPTO has begun to redesign aspects of the system to better meet users' current needs and to expand its functionality and purpose. Our major goal was to assist the Patent Office in conducting a needs assessment to ignite this redesign process. Through interviewing multiple user groups of IQS within the Office of Patent Quality Assurance and Patent Ops, we were able to make some general conclusions about the current version, record requested changes or improvements, and visually design some examples of how these changes could look and fit into the newest update of IQS.

One of the major conclusions we came to when interviewing employees from both offices was that IQS was created to be a shared workspace for the OPQA and Patent Ops, but the functionality better meshes with the job description of the OPQA. For this reason, Patent Ops employees have spent less time on IQS and more time on other existing systems that better assist them with their job. While not every aspect of the Patent Ops employees' work necessarily belongs in a quality assurance system, increasing some functionality on IQS would help limit the number of different systems that the Patent Ops employees need to use.

Tickler Report Pages

Purpose

This page relates to a given category of cases.

In using this page, the Quality Lead desires to accomplish the following tasks:

- To view a listing of cases in the present category

Design

The page is comprised of a table. The table shall list cases in the present category as rows.

Highlighting. The rows of the table shall be highlighted according to how long the corresponding case has been in the present category.

Sorting. The user shall be able to sort the rows of the table by any column in either ascending or descending order.

Export. The table shall be accompanied by a button allowing the user to export the table in a format that can be imported in Microsoft Excel.

Figure 35: Sample Design Specs

The OPQA uses IQS daily to complete most of their job roles. This includes completing MRF forms on randomly-selected cases, reviewing internal data, and completing other tasks within the OPQA. Generally speaking, the Quality Leads expressed the desire for more production, consistency and timeliness data to manage their RQAS more efficiently and with less manual manipulation. Differently, the RQAS overall were satisfied the amount of information that they have been given but requested the addition of a few individual metrics. The RQAS requested more needs for features to increase usability of IQS as a whole. The recommendations we provided for both the QLs and the RQAS incorporated our own ideas of data display and ensured it was consistent with current practices in the OPQA to limit the learning curve of newly implemented features and visuals.

On the other hand, the Patent Operations Team uses IQS for the purposes of managing all reviewed cases, alleged non-compliances raised from the OPQA, and error trends. SPEs utilize the OC system to complete most of their Quality Tracker review forms and prefer that system to IQS. MQAS use the system to analyze the data in a way to realize overarching problem trends within Art Units, work groups, or the TC as a whole. Directors simply use the IQS system to track production and errors of everything quality assurance related within the work group. We made some recommendations in different reports that could make gathering the users' review data easier, also adding other customizability features that could improve the user experience overall.

By providing mockups on various platforms, we were able to visually supplement the major source of information that was delivered to our sponsor liaisons – our design specifications. These design specifications were created to explain the major purpose of each major request within each user group, and to document our detailed recommendations for how to address these suggestions. Some of the recommendations were more specific than others, depending on our knowledge and the time we had for this development. By giving Martin Rater and Daniel Sullivan a copy of these design specifications, corresponding images, interview results, and our final report, we have provided a general idea of some of the changes and information that might need to be implemented into IQS on the major update. We hope this information will spark conversations and thoughts that upper management had not previously considered. Our liaisons will then be able to dive deeper into our findings and create a list of more concrete and finalized features to eventually implement into IQS.

Table 3: List of All Interviewees

Quality Leads	RQAS	Directors	MQAS	SPEs
Tom Hughes	Kevin Teska	John Barlow	Tod Swann	Jenny Wagner
Cassandra Spyrou	Crescelle Delatorre	Nestor Ramirez	Corrine McDermott	Andrew Caldwell
Larry Helms	Drew Koenig	Joe Thomas	Brian Sircus	Daniel Washburn
Mary Beth Jones	Ryan Stiglic	Eddie Lefkowitz	Paul Rodriguez	Michael Cleveland
Vei-Chung Liang (VC)	Michael Schaper	Gladys Corcoran	Dave Ometz	Christine Behncke
Diana Dudash	Oren Ginsberg	Tariq Hafiz	Zach Lucas	Shelley Self
Sudanshu Pathak	Kay Kim	Jerry Lorengo		Brandon Fetrerolf
	Anthony McFarlane	Daniel Sullivan		
	Newton Edwards			
	Khan Nguyen			

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Supplemental Materials and Design Specifications for this project may be found at https://digitalcommons.wpi.edu/studentprojectsandresearch/ by entering this report's title in the search bar. When the window appears, click on the appropriate project title and scroll down to "additional files".