ABOUT QUEST

Quality Enhancement Systems and Teams (QUEST) is a multidisciplinary engineering, technology and management program at the University of Maryland. Students participate in a challenging course of study that focuses on quality management, process improvement, and system design. Funded in 1993 by a grant from IBM to establish total quality on university campuses, the University of Maryland has continued the program which has produced excellent graduates prepared to face the changing landscape of business, engineering, and technology.

QUEST Honors Program
1407 Van Munching Hall
University of Maryland
College Park, MD 20742
December, 2014

Dear QUEST Seniors:

Please accept my congratulations on your successful completion of the QUEST capstone project. The program is designed to be challenging and academically rigorous, so you can take pride in your accomplishments.

Any program that combines the words “quality,” “enhancement” and “teams” in its name reflects the environment you may encounter when you graduate. The cooperative give-and-take of cross-disciplinary teams in search of practical solutions is an important experience in your future professional endeavors. Organizations that look for these qualities tend to succeed and are a lot more pleasant places to work. The international, cross-border component to the program will prove increasingly valuable in this global economy.

QUEST has a vibrant alumni network, so I hope you will stay in touch after you graduate. All of us at the university are proud of your accomplishments. We wish you the best in your conference presentations and in the next phase of your lives.

Sincerely,

Wallace D. Loh
President
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Appian is a market leader in business process management (BPM) software. Appian delivers an application platform which allows its clients to manage business processes while connecting people and applications. The platform connects the power of mobile, cloud, and social technologies to drive high-value improvement across the enterprise, through the supply chain, and out to customers. With more than 3.5 million users worldwide, Appian has a vibrant and growing community of customers and partners across multiple industries and geographies.

Our team was tasked with creating a more robust user feedback system at Appian. Although the current development process at Appian is guided by a strong strategic vision, we recognized the need to further integrate feedback from Appian’s customers to enhance our client’s software development lifecycle. Our solution leverages Appian’s business process management acumen to collect, organize, and display user data in a usable and actionable fashion. Ultimately, this solution can help Appian identify the success of developed features and plan future iterations of the Appian product.

**Contributions and Recommendations**

To create an effective feedback cycle that translates data into insight for future development, we implemented the lean methodology paradigm. Initially, we conducted interviews with Appian product managers to define metrics for a successful feedback process, researched data analysis tools, and presented a preliminary solution. Our interviews yielded a set of key characteristics for an ideal system; we learned that the proposed system must collect feedback non-intrusively and organize data in an accessible and actionable manner.

Our research culminated in the creation of an integrated feedback process and dashboard interface. Our process facilitates the creation of success metrics for every feature in development and requires product managers to evaluate their project by these standards after its release. Related data is collected after the project’s release and is displayed using the dashboard interface to ease the evaluation process.
Integrating Feedback into Software Development

Appian Corporation is a market leader in business process management software. They deliver a platform to build custom applications through the power of mobile, cloud, and social technologies.

We created a process to facilitate future feature development with an interface that organizes feedback and translates data into insight.

Opportunity

Appian sees a method for integrating feedback into their agile software development workflow. Currently, Appian has no formal process of analyzing feedback, relying on instinct to guide feature prioritization. Our goals include:

- Increase awareness of customer behavior by streamlining feedback process
- Leverage insights from usage data to guide future product development

Research & Analysis

1. Interviews with Appian employees
2. Review of existing ad hoc customer feedback
3. Observation of other software companies’ methods of utilizing feedback

"We have copious amounts of data, but no specific way of analyzing them."

Defining metrics early will allow Appian to measure success on existing features and make informed decisions about future features.

“A successful feature makes the user productive and fulfills their business needs.”

Solution

We modified the specification documents to include defining key metrics per feature. Corresponding data is collected for each customer and visualized in a new Insights dashboard within Appian’s Records suite. Product Managers and other stakeholders will reference Insights when prioritizing new projects and are able to justify their decisions by measuring the results.

Team Pursuit of Appianess

Janani Ganesan, Jeff Killeen, Shirley Han, Rolio Vined, Steven Silberholz
Special thanks to Allison Cowley, Project Champion, and Dr. Ed Parton, Faculty Advisor
**The QUEST - ATK Project**

**Improving Cash Forecasting Practices**

**QUEST Student Team: The A-TEAM**

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<tr>
<th>Alexandra Glakas</th>
<th>Stanley Li Information Systems and Operations Management</th>
<th>Pavan Rangachar Finance</th>
<th>James Shen Finance and Accounting</th>
<th>Emmeline Zhu Electrical Engineering</th>
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**Project Champions**

- Kevin Schoonover, Director of Business Development & Strategy
- Ann Humphrey, Controller at Missile Products Division

**Faculty Advisor:**

- Dr. Hassan Ibrahim
  - Clinical Professor, Decision, Operations, and Information Technologies

**Project Scope**

Alliant Techsystems Inc. (ATK) Defense Group develops and manufactures highly engineered materials and products that support mission-critical applications for defense, aerospace, and security customers. ATK Defense Group consists of 4 divisions, Missile Products, Armament Systems, Defense Electronic Systems, and Small Caliber Systems. Each division is located in a different location (Maryland, Minnesota, California, and Missouri). In planning for future projects and evaluating cash on hand, each group has financial analysts who forecast cash out based on the group's individual contracts, projects, and/or clients.

ATK Defense Group currently has a set of methodologies to forecast cash in a given timeframe. The opportunity for improvement lies in reducing the variance between forecasted cash for a specified timeframe (based on contracts, projects, clients, and expenses) and the actual cash on hand in the future timeframe. The project revolves around evaluating ATK’s current forecasting methodologies and conducting extensive industry research to make recommendations, which reduce the variance between cash forecasts and actual cash on hand. This can allow ATK to better allocate monetary resources for future projects and better manage inventory levels.

**Contributions and Recommendations**

The team gathered information by conducting individual interviews with five current financial analysts within ATK and a host of other QUEST and UMD alumni with industry experience in cash flow forecasting. The team also utilized case studies and equity research materials to gather additional data. After conducting external research, the team isolated a key variable (based on historical averages), which can lead to industry best practices when forecasting cash flow. This helped segment clients when forecasting cash out on a client-by-client basis. After back testing this variable on historical data, the team was able to provide a recommendation on how to segment clients. The key variable then assisted in providing a frame of reference on how to forecast cash for one particular client segment.
ATK Missile Products Division
Improving Cash Forecasting Practices

I. Client
Alliant Techsystems (ATK) Defense Group is a publicly traded aerospace, defense, and sporting goods firm with over $4.78 billion in revenue.

II. Challenge
ATK forecasts its cash on a regular basis in order to plan for future operations.

III. Opportunity
Research industry-wide cash forecasting methodologies to then make recommendations which can help reduce variance.

IV. Methodology
- Primary Research
- Secondary Research
- Cash Flow Model Analysis
- Isolation of Variable(s) to improve
- Historical Billing Data Analysis

V. Recommendations and Benefits
Provide a framework to segment clients:
1. Filter clients based on historical billing data
2. Filter clients based on contract structure
3. Forecast clients to pay relative to month of invoice date (M)

Simplify Cash Forecasting Process for Clients Who Pay Late

The A-Team
Alexandra Olaikas
Stanley Li
Pavan Rangachar
James Shen
Emmeline Zhu

Finance and French
Info Systems and Operations Management
Finance
Finance and Accounting
Electrical Engineering

Acknowledgements
Project Champion: Kevin Schoonover
Ann Humphrey
Dr. Hassan Ibrahim
Special Thanks To: The Quality Guild

UNIVERSITY OF MARYLAND
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PROJECT SCOPE

Founded in 1990, Alliant Techsystems (ATK) is a defense and aerospace contractor that performs general contracting in both private and public sectors. Of their three groups -- aerospace, defense, and sporting -- we have been working within the defense group, specifically the Missile Products Division. Headquartered in Baltimore, MD, the Missile Products Division aims to develop advanced missile-interceptor capabilities and engineering technologies for the energy industry as well as to develop and produce tactical rocket motors and missile systems for land, air, space, and sea.

The Ultimate Alliance refined and improved upon the existing efforts of the ATK Missile Products Division to streamline their bid and proposal process. The central opportunity to increase internal efficiency is focused on not only streamlining the internal processes, but establishing management transparency between stakeholders, as well as emphasizing the importance of the customer proposal. Implementation of the Ultimate Alliance’s recommendations would enable ATK to process more bids at a higher quality, spending discretionary funds more efficiently, and ultimately providing more value to clients.

CONTRIBUTIONS AND RECOMMENDATIONS

The Ultimate Alliance created recommendations through a three tiered dynamic methodology: first defining current state through interviews, then refinement and data gathering through surveys, and finally creating a phasing plan with short and long term recommendations through upper level management meetings. Our recommendations include reversing the current state of internal documents first to focus on building customer proposals and then to supporting internal decision making, emphasizing the voice of the customer throughout. The team also recommends transparency across all management levels resulting in program managers telling their story rather than completing a pre-determined series of charts and tables and allowing for better decision making by upper management. These recommendations will bring bid and proposal stakeholders from all levels to a common ground regarding the current state.
The Ultimate Alliance
Fueling Systemic Transparency
A critical analysis of Bid & Proposal processes with Alliant Techsystems

Recommendation Plan:

Phase I - Awareness and Baseline
- Synthesize experience of all ATK employees to reach a common understanding of current and ideal processes

Phase II - Determine Direction
- Assist and guide ATK management in determining the most effective course of action based upon data analysis

Phase III - Self-Reliance
- Leave ATK with a sense of momentum and the structure for continued progress

New Delegation Process:

Current: Template-based
Next: Scripted Improvisation
Guided by:
1) Three Rules
   A. Tell the Story
   B. Focus on Proposal
   C. Maintain Transparency and Communication
2) Three Core Components
   D. ATK Risk Assessment
   E. Financial Analysis
   F. Bid Win Strategy

Improvisation acts as guidelines for ATK employees to tell a ‘story’ of why a proposal will benefit the company and result in customer satisfaction

Opportunity:
Identify opportunities for ATK to decrease spending while increasing efficiency within the Bid & Proposal process.

Overview of ATK:
Alliant Techsystems Inc. Defense Group is a cutting-edge military defense contractor specializing in high-tech ballistics delivery systems

Project Methodology:

Build Phase III Momentum Throughout
- Personal Interviews
  - Determine Current State
  - Find opportunities for improvement
- Group Meetings
  - Initiate Phase I
  - Determine management stakeholder needs
- Internal Communications
  - Describe Phase II
  - Initiate change in all management levels

Setting the Stage:

Transparency
Flexibility
Customer Centric mentality
Time spent on internal documents

The Ultimate Alliance
Caitlin Myers
Allan Nicholas
Allison Thompson
Michael Shindledeker

A Special Thanks To:
Kevin Schoonover
Joseph Bailey
The QUEST - AT&T Project

Gamification: Rethinking Cybersecurity Training

Quest Student Team: 47&7 Consulting

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Project Champion:
Gerry McKenna
Executive Director, Cybersecurity Product Development, AT&T Government Solutions

Faculty Advisor:
Dr. James Purtilo
Associate Professor, Computer Science

Project Scope

Managed Security Services is a division of the AT&T Enterprise business that provides a proactive approach to network security for their external client organizations. With offices based out of Columbia, Maryland, they aim to help prevent and lessen the impact cyber-attacks can have on businesses. With over 1,500 security experts and support professionals, this sector provides services including: Managed Trusted IP Services, Internet Protective Services, DDos Mitigation, Email and Web filtering, and more.

Cybersecurity training has become a requirement for any company in the technology-driven age. New vulnerabilities appear on a daily basis and a successful attack could be devastating. All AT&T employees receive cybersecurity training, but information retention can be improved. AT&T training currently emphasizes the impact of phishing attacks and according to a report by the Anti-Phishing Working Group, 125,215 unique phishing sites were observed globally in Q1 of 2014. This is a 10.7% increase from Q4 of 2013. Our project evaluates AT&T’s current phishing training and offers an innovative tool to measure employee success.

Contributions and Recommendations

While using Kirkpatrick’s Learning Evaluation Model to guide our surveys and focus groups, we hypothesized that employees wanted more interactive, shorter, and more frequent trainings that feature more real life examples. After collecting responses to our survey, we computed exploratory statistics and chi square tests to analyze our data. We found that 80% of employees want more customized training, at the same or greater frequency. Employees rated use of current events and training frequency among the top three factors perceived to be important in their training.

To meet these needs, our team recommends applying gamification principles to training. We designed a phishing-email identification game as a pilot and created a mobile app to act as a platform for future education games. This would meet the training’s education requirements, while also allowing for more customized games to satisfy the employees’ needs.
Gamification: Rethinking Cybersecurity Training

I. Client
As a division of the AT&T Enterprise Business, Managed Security Services provides a proactive approach to network security for external organizations. AT&T's annual training is currently focused on phishing, using their character Murray to bring awareness to employees.

II. Opportunity
Scope: Phishing attacks have become one of the greatest risks for the current corporate landscape. Our client wanted a seamless process to analyze how well employees retain information learned in annual training.
Goal: To design and introduce an innovative tool that allows for continuous data collection.

III. Methodology

IV. Analysis
>80% want customized training
55% of employees identified suspicious attachments
45% of employees did NOT identify suspicious attachments
only 32% apply training on a daily basis

V. Recommendations
Biannual Training, Gamify, Mobile Platform, Rewards

In Q1 2014, there were 125,215 unique phishing sites observed, a 10.7% increase from Q4 2013.¹

47&7 Consulting:
Amanda Minken, Eric Zinnikas, Hasan Masood, Kae David, Katie Cauley

Acknowledgements:
Champion: Gerry McKenna
Faculty Advisor: Dr. Jim Purtillo
QUEST Quality Guild & Cohort 20

THE QUEST - BAKED BY YAELE PROJECT
CAKEPOP PACKAGING, STORAGE, AND DISPLAY

PROJECT SCOPE
Baked by Yael is an independent bakery which features decadent cakepops as the main product. Currently in the middle of transforming from an online business to an in-store bakery, Baked by Yael is set to be the first cakepoppery in Washington, D.C. This brand new, one of a kind shop will be located across from the National Zoo and will open at the end of December 2014. Moving the business from online to in-store necessitates changes that can have long lasting impacts, shaping the way the business is run and how it is perceived by customers for many years into the future. There were three unique deliverables, each with their own individual goal:

- Cakepop Packaging – create a way to distribute cakepops of quantities 6 & 12 to in-store customers
- Freezer Storage – create a freezer organization system with first in, first out accessibility that protects cakepops
- Display – design a storefront display that captures Baked by Yael’s brand and attracts customers

These deliverables will help create efficient processes for storing and distributing cakepops as Baked by Yael grows into the new store.

CONTRIBUTIONS AND RECOMMENDATIONS
Our team used an affinity diagram and House of Quality to brainstorm ideas and iterate designs. By establishing key characteristics, initial ideas were formed and presented to the client. After receiving feedback and testing prototypes, designs were improved to match the client’s needs:

- Molding - Designed a 3D rendering for inserts, then printed and tested the design.
  
  Client’s Initial Vendor (Injection Molding): Tooling: $5,000-$6,000; Inserts: $1.36 per insert
  
  Our Final Vendor (Vacuum Forming): Tooling: $2,900; Insets: $1.25 per insert
- Freezer - Developed an efficient system and found cost effective containers for storage and organization of uncoated cake balls. Stores 14,400 cakeballs (12 different flavors, 1,200 cakeballs of each flavor at once, 400 cakeballs per batch).
- Display - Created a storefront display to give a physical presence to the Baked by Yael brand. Display allows for customization based on seasons and different design choices.
Beckton Dickinson (BD) is a Fortune 500 medical technology company. The Diagnostics division, headquartered in Baltimore, MD, is responsible for manufacturing single-use, disposable products known as consumables. Millions of patients across the world depend on these consumables for fast and reliable diagnostic testing.

As a result of the critical nature of these products, it is imperative that BD is able to fulfill customer orders. To ensure that BD does not stock out, it manufactures extra units - known as safety stock - to mitigate the risk of underestimating demand. Although safety stock protects against a stock-out, it increases the risk of the stock expiring before reaching the end customer, resulting in stock loss. Our project goal is to provide safety stock recommendations that reduce the stock loss for the consumable products while maintaining high customer service levels. For the products in scope, BD experienced a stock loss in the order of hundreds of thousands of dollars in the past year.

**Contributions and Recommendations**

We took a streamlined approach in building and testing safety stock models. We first built a simulator that back-tested any given safety stock model and evaluated its effectiveness in reducing stock loss and improving customer service levels. We then built three models that provided safety stock recommendations based on a variety of factors, including forecast error, inventory levels, and shelf-life days. Finally, we ran a simulation to evaluate the three models and selected the best performing model - which led to a 24.5% reduction in stock loss and a 9.5% boost in customer service level. We believe that our strongest contribution is the incorporation of shelf-life days into the safety stock calculation because it provides a more granular understanding of inventory state. Our final deliverable to the client is a user-friendly tool that accepts SAP-generated reports as inputs and provides safety stock recommendations per product. To ensure a smooth implementation and boost adoption rates, we created and shared a job-aid, which provides step-by-step usage instructions. Moving forward, our recommendation is for BD to use this model on a monthly basis to determine safety stock levels.
Minimize Stock Loss
Through Safety Stock Recommendations

Client Introduction

BD
Becton Dickinson (BD) is a Fortune 500 medical technology company. The company’s Diagnostics segment manufactures and sells single-use, consumable products among other medical devices. Examples of consumables include agar plates and test tubes.

Millions of patients across the world depend on these consumables for fast and reliable diagnostic testing

Current State

$750K
Annual Stock Loss

92-96%
Customer Service Level
Across 350 SKU’s

Opportunity

BD manufactures extra stock to mitigate risk of uncertain demand. This is known as safety stock.
Manufacturing too much safety stock can be costly because it may expire before it reaches the end customer. Expired inventory is known as stock loss.

Our objective is to minimize stock loss by incorporating shelf-life days into safety stock recommendations.

Results

24.5%
Stock Loss Reduction

$183,750
Estimated Savings

9.5%
Customer Service Improvement

Methodology & Deliverables

Understand
Understand current operating procedures and build a simulator that back-tests and evaluates model effectiveness

Build
Build safety stock models that aim to reduce stock loss while maintaining high customer service levels

Package
Package model into user-friendly spreadsheet and create job-aid to ensure a smooth and successful implementation

Meet the Team

Matt Henricks
B.S. Information Systems & Computer Science

Katarina Balinicher
B.S. Supply Chain Management & Finance

Peter Weng
B.S. Physiology & Neurobiology and B.A. Economics

Erica Yingling
B.S. Microbiology

Raja Ayyagari
B.S. Computer Science

Special Thanks to
Elizabeth Perrin
Project Champion

Dr. Hassan Bakhshi
Faculty Advisor

Jim McAllister & Bryan Towns
Co-champions
**PROJECT SCOPE**

Bowles Fluidics Corporation (BFC) is an engineering company specializing in fluid logic and circuits. With nearly three hundred patents, BFC has a product line encompassing nozzles, shower heads, pulsers, valves, massaging devices and more. BFC operates two facilities: one at their headquarters in Columbia, MD where all components are produced using injection molding, and one in Fresnillo, Mexico where component parts are assembled into finished goods before being shipped to clients around the world including Toyota, Honda, Nissan, and Swiffer.

Each day, approximately 130 boxes of molded components pass through BFC’s Integrated Quality Area (IQA). During initial inspection, BFC uses a single sampling scheme, only inspecting one piece per container. Although BFC produces 452 unique part numbers, this method is used universally. For every 1 defect found in initial inspection, 2 remain undetected until final assembly. Detecting defects so late in the process results in higher costs and operational inefficiencies. BFC is seeking to create a system that maintains relative time neutrality, while increasing the percentage of defects caught during initial inspection.

**CONTRIBUTIONS AND RECOMMENDATIONS**

Our recommendation to BFC is a categorization-based inspection method. Since the probability of defect varies significantly across part numbers, we recommend a system with two different groups. In order to determine the best sampling scheme for each of these groups, we ran a Monte Carlo simulation for various methods. Using the results, we determined that historically well-performing parts will be inspected using a relaxed, skip-lot sampling method, while marginal parts will be scrutinized using a tightened, double sampling method. If a part number has five consecutive passing lots, it will move to the relaxed state. If one lot of a part number fails, it will move to the tightened state. The new system will allow BFC to concentrate its resources on parts which have a higher probability of defect. Further, we recommend that BFC utilize a temporary one-shot method to facilitate initial categorization during system implementation.
**Improving Quality Assurance**

**Categorization-Based Approach to the Inspection Process**

**MISSION**

Increase efficiency and effectiveness of component inspection at Bowles Fluidics.

**Bowles Fluidics Corporation**

Bowles Fluidics Corporation (BFC) is an engineering company in Columbia, Maryland that specializes in fluid logic and circuits. BFC produces more than 260 million injection molded nozzles and parts each year for automotive and non-automotive industries.

**In the Integrated Quality Area (IQA), all parts are treated equally utilizing a single sample inspection method.**

**Opportunity:**

66% Defects currently undetected in the Columbia IQA prior to final assembly.

**PROPOSED SYSTEM**

**RELAXED STATE**

**SKIP LOT SAMPLING SCHEME**

- Only first and last box inspected
- Significant time savings
- Parts assumed to be high quality

**TIGHTENED STATE**

**DOUBLE SAMPLING SCHEME**

- Quick Switch
  - One Defective Lot
  - (Switches verified by a Quality Engineer)
  - Five Consecutive Non-defective Lots
  - Resampling for more data
  - Increased detection
  - Marginal increases in time

**ANALYSIS**

- Histogram of Defect Rates
  - The distribution of part defect rates, with a mean of 4.5%, shows that the majority exist outside of the pronounced relaxed and tightened areas. Therefore, the system constitutes an implementation plan to determine initial part categorization.

**CONCLUSION**

- After researching acceptance sampling methods, we determined that designing a feasible inspection system requires a balance between resource constraints and statistical significance.

- Considering existing time and cost constraints, we recommend the following to BFC:
  1. Allow relaxed inspection for parts with historically high quality, permitting tightened inspection for marginal parts.
  2. Leverage the capabilities of the newly integrated ERP system to actively categorize part numbers.
  3. Reduce lot size to contain boxes with possible defects, mitigating risks associated with missed defects.
  4. Utilize a temporary one-shot method to facilitate initial categorization during system implementation.

*Project Champion: Chi Scimah, Wexsa Fernandez-Moya
Faculty Advisor: Dr. Pamela Armstrong
Course Faculty: Kyle King, Dr. Jeffrey Herrmann*
**THE QUEST - LUTRON ELECTRONICS PROJECT**

**SCORING THE SUSTAINABILITY OF LUTRON SHADES**

**QUEST STUDENT TEAM: CARBON BLACK**

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<tr>
<td>Electrical Engineering</td>
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<th>Project Champion:</th>
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<tr>
<td>Joel Shumsky</td>
<td>Dr. Michael Ohadi</td>
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<tr>
<td>Senior Project Electrical Engineer</td>
<td>Professor, Mechanical Engineering</td>
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**PROJECT SCOPE**

Lutron Electronics, Inc. is a privately held corporation that designs, manufacturers, and sells advanced lighting control systems. Since its incorporation in 1961, Lutron Electronics has been at the forefront of lighting innovation due to their energy efficient and cost effective lighting solutions.

Lutron Electronics has identified a business opportunity at the University of Maryland based upon its analysis of the University’s campus plan. The UMD initiative calls for dramatic increases in energy efficiency across the entire campus by 2015.

Currently there are no metrics for Lutron to evaluate the environmental and monetary benefits of installing autonomous lighting and shading systems in classrooms at Maryland. We have created an estimated price of installation and a rate of return for a Lutron lighting solution in Van Munching Hall. Our report includes the projected cost savings for the building in terms of increased energy efficiency and reduced light usage in Van Munching Hall. Data suggests that classrooms in Van Munching Hall could be up to 58% more efficient.

**CONTRIBUTIONS AND RECOMMENDATIONS**

Using light and occupancy data log sensors, we determined the “black holes” present in Van Munching Hall; i.e., the spaces that wasted lighting when no one was present. A follow up audit of each space allowed us to identify specific Lutron solutions for each room.

After drawing conclusions from our data, we decided to recommend two sets of solutions for Lutron. The first are “easy reach” solutions that address low hanging fruit in energy wastes. These easy reach solutions have stand-alone systems with quick payback periods. This makes their installation attractive to both maintenance and UMD administrators.

Our recommendation for a “long-term” solution consists of Lutron’s Quantum Solution or Lutron’s Quantum Processing System with Lutron’s Hyperion Shading System. This more expensive option would provide additional qualitative benefits including total light system integration.
PwC is a large network of firms in 157 countries with more than 184,000 people. The firm provides industry-focused audit, tax, and advisory services to both federal and commercial clients. It is currently the sixth-largest privately owned organization in the US. reinQUESTment is working directly with an account team in the Public Sector Practice out of Mclean, VA.

The PwC advisory team that works with The Department of Homeland Security is interested in improving the way they select and assign reinvestment projects (internal projects undertaken by PwC employees to better themselves and the firm). Centralizing the communication around reinvestment will reduce fragmented efforts and formalize the process. Without explicit prioritization, staff will continue to distribute their time amongst smaller, isolated, and less meaningful initiatives. Our team was tasked with creating a solution that fully addressed the issues of prioritization, communication, and skills-matching. Ultimately our solution is developed to encourage productivity and accountability, while minimizing administrative burden.

CONTRIBUTIONS AND RECOMMENDATIONS

After conducting 19 interviews with staff and management, feedback indicated that there was not an established process to connect employees’ skills in a way that best meets management objectives. The existing PwC platform, Spark, offers the Ready to Reinvest page (R2R), which is a centralized location for all reinvestment initiatives. It also allows employees to apply or be recommended based on their skill set. It is currently not being fully utilized, with only 1,259 active users out of 25,000 in the advisory practice at PwC.

In order to drive traffic to the R2R page, all reinvestment communications must channel people to this central source. This requires a standardized process flow so that any level of employee is able to understand their next steps in creating or applying to a project. Using our process, our goal is to have all 111 DHS employees interacting with the R2R page when selecting reinvestment projects and eventually to extrapolate this to the entire Advisory practice.
Ready to Reinvest! Reinvestment is taking on internal projects unique to your skillset to better both yourself and the firm

New Content
Ready to Reinvest! Was created to centralize personal and professional opportunities. Click here to submit a reinvest project proposal.
Need help using the website? Click here to view demo videos!

New Processes
I want to reinvest → Project Search → Select a project → Sign up → Nominate
To view more information about the process, click here.

New Criteria
- Probability of Success: 20%
- Brand Image: 20%
- Strategic Value: 20%
- Firm Support: 15%
- Potential for Skill Development: 10%
- Bounded Scope: 10%
- Internal Networking: 5%

Need to evaluate a project proposal? Click here for the evaluation template.

Current active R2R users: 1,259 out of 25,000
- 12,500 After one year
- 2,500 Long Term

SPARK is already in place and is the most streamlined and centralized tool for reinvestment.
The QUEST - Spectrum Foods Project

Warehouse Space Optimization

Quest Student Team: Early Bird Consulting

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<td>Mechanical Engineering</td>
<td>Civil Engineering</td>
<td>Economics, Finance, and Mathematics</td>
<td>Accounting and Operations Management</td>
<td>Finance and Economics</td>
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Project Champion:
Josh Fanaroff
General Manager

Faculty Advisor:
Dr. Jeffrey Herrmann
Associate Professor, Mechanical Engineering

Project Scope

Spectrum Foods is a family owned poultry and foods distributor for local restaurants, wholesalers, and ethnic grocery stores in the Greater Washington Area. Since purchasing the Landover, Maryland facility in 2002, Spectrum Foods has more than doubled its revenue to $75.5 million. Founder and owner David Fanaroff attributes the high growth to his customer-centric business model. Spectrum Foods has easy access to the capital beltway, which enables them to provide reliable, timely shipments and flexible order fulfillment.

Every morning, Fanaroff must arrive at the warehouse by 2:30am. On a high volume work day, the operations at Spectrum run from approximately 3:30am through 12:00pm. Currently, Spectrum’s business volume is quickly outgrowing the limited warehouse space of 50,000 square feet. As a result, Fanaroff has to spend more time at the facility monitoring the increased activity flow and employees have to work more overtime. Early Bird Consulting (EBC) is tasked with reducing the daily operating time by decreasing the time to load pallets onto the trucks. This time reduction frees up personal downtime for Fanaroff, creates opportunities to increase revenue, and bolsters Spectrum’s recent growth momentum of approximately 8% annually for the past five years.

Contributions and Recommendations

After observing the operation and interviewing key stakeholders of the business, the team identified two key areas to improve operational time efficiency. First, EBC reorganized the pallet layout in the cooler area to reduce time per trip to the cooler. Through lean methods, the team expanded aisle space to improve traffic flow, optimized pallet spacing to increase pallet storage, and designated specific pallet areas to keep the area organized. Second, EBC designated spaces on the loading dock to reduce loading times and traffic bottlenecks. The five designated spaces each have corresponding line stations to optimize dock door to building area distance. In addition, the spaces cleared by having organized areas will improve safety and traffic flow during the day.

Combining the two recommendations, the team arrived at a base savings of 22-33 minutes per day, comparing the collected data of the current process and the estimated time from reduced distance and improved traffic flow. Annually, this amounts to 114-172 hours saved and a potential revenue increase of $6.6-10.0 million.
WAREHOUSE SPACE OPTIMIZATION

CLIENT
Spectrum Foods is a family operated poultry distributor located in Landover, Maryland serving local eateries. By reducing the loading time the company can invest in more potential clients and sustain new plans and inventory.

GOAL
To reduce loading time by 10%.

SCOPE
To optimize the space and improve the process flow of the cooler and loading dock.

CURRENT STATE
32 Daily Outbound Trucks
12 Loading Dock Areas
5 Hours for loading per day

APPROACH
Early Bird Consulting conducted a time study and developed new layouts for the refrigeration room (cooler) and loading dock. The predicted time and cost savings are based on the recommended layout changes and associated impacts.

CURRENT COOLER
IMPACT
4% reduction in item retrieval time
2 additional aisles
4.5% increase storage capacity

CURRENT LOADING DOCK
IMPACT
Improved safety in densely utilized areas
>1% foreseeable reduction in traffic

IDEAL COOLER

IDEAL LOADING DOCK

>1,245 square feet designated for building pallets

BASE TIME REDUCTION: 7-11%
POTENTIAL ADDED REVENUE: $6.6-10.0 million
Thales Defense & Security, Inc is a global leader in the development, manufacture, and support of battle-proven, software-defined radio equipment. It is a proxy company that serves the U.S. Department of Defense and the U.S. Department of Homeland Security as a wholly owned subsidiary on the Thales Group. Thales designs and manufactures rugged communication solutions for constrained environments, while providing lifelong support for their solutions. Thales is headquartered in Clarksburg, Maryland where they maintain labs to design and manufacture their communication solutions.

Thales struggles to obtain accurate information about equipment location within the Thales lab facility. The Thalesmen sought to develop a streamlined way of assigning, tracking, and managing engineering equipment throughout its lifecycle while taking all stakeholder needs and priorities into account. The company motto for Thales is, “Lives Depend On What We Do.” That means that every moment an engineer or technician uses to find a piece of missing equipment is a moment taken away from helping a soldier in the field. The Thalesmen look to minimize this waste and allow the Thales staff to focus on their research.

CONTRIBUTIONS AND RECOMMENDATIONS

Our research helped us arrive at three critical objectives. Our ideal asset management system decreases costly overhead, increases the speed at which equipment is found, and boosts employee efficiency. After revising our preliminary solutions, our team decided on a hybrid system. We are recommending the Wasp Barcode Scanner system as the key component of our solution. Engineers scan a piece of equipment as well as their badge. That information is then recorded in a master database. Our next solution is to add a central storage unit in the lab with designated drawers for the smaller, shared equipment that is not in use. We also recommend a weekly allocation of time for staff members to return equipment to its appropriate area. Finally, we will make use of existing RFID capabilities to monitor smaller, more commonly misplaced items. Together, these recommendations for asset management at Thales will have a projected estimated savings of $29,000.
TRACKING LAB EQUIPMENT AT THALES

I. METHODOLOGY

I. INTERVIEWS
10 one-on-one interviews with engineers and technicians, used to obtain an array of different perspectives and define the problem scope

II. SURVEY
An anonymous questionnaire through which over 20 people provided quantitative analysis on the current state of the lab and the potential openness to our solution

III. FOCUS GROUP
30 engineers brought together to garner ideas for potential solutions to problem

IV. JOINT DEVELOPMENT
30 engineers brought together to discuss feasibility of the implementation plan

II. CURRENT STATUS

5-15 MINUTES
Average time range spent locating for small items

1-5 MINUTES
Average time range spent locating for large items

70% OF EMPLOYEES
Willing to adhere to a manual system, e.g., mandatory clean-up

III. RECOMMENDATION
INTEGRATE FOUR COMPONENTS FOR ONE COMPLETE SOLUTION

WASP
A barcode system designed for equipment tracking

SHELVING
Central location for commonly used equipment

RFID
RFID tags for smaller, commonly misplaced items

CLEAN UP
Mandatory organization of lab equipment every two weeks

IV. SOLUTION BENEFIT
ESTIMATED PROJECTED SAVINGS OF $29,000/YEAR

10X LESS EXPENSIVE
Than a system that relies on bar coding

3X FASTER
Than a solution that relies on barcode scanning

10X FASTER
Than a solution that relies on shelves

THALES
Thales Defense & Security, Inc. serves U.S. federal defense agencies through the “development, manufactures, and support of battle-proven, software-defined radio equipment.” They design and manufacture innovative rugged communication solutions for size, weight, and power constrained environments while providing lifelong support for their solutions. Thales is headquartered in Clarksburg, Maryland where they maintain labs to design and manufacture their innovative communication solutions.

THE THALES MEN

Cheryl Rosenberg
Information Systems, Marketing

Ethan Schindel
Hardware, Science and Engineering

Paige Nelson
Computer Science

Matt Schmitt
Supply Chain Management, Marketing

Rebecca Zubajlo
Business Engineering

SPECIAL THANKS:
Steve Kutchi
Project Champion
Dr. Jeffrey Herrmann
Facility Advisor

[Image of the Thales Development team]
The QUEST - Tulkoff and T.W. Garner Project  
Deer Repellent From Waste Product

**Quest Student Team: Artemis Solutions**

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
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<tbody>
<tr>
<td>Yoni Kozlowski</td>
<td>Bioengineering</td>
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<tr>
<td>Kenny Lopez</td>
<td>Materials Engineering</td>
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<tr>
<td>Mark Nathanson</td>
<td>Mechanical Engineering</td>
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<tr>
<td>Isa Oporto</td>
<td>Finance and Operations</td>
</tr>
<tr>
<td>Grace Zhang</td>
<td>Biology and Operations</td>
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**Project Champion:**  
Phil Tulkoff  
Chief Executive Officer, Tulkoff Foods

**Faculty Advisor:**  
David Ashley, M.B.A.  
Executive in Residence, Robert H. Smith School of Business

**Project Scope**

Artemis Solutions worked with two clients in the food industry, both of which primarily produce condiments. Tulkoff Food Products Inc., based in Baltimore, Maryland, is recognized as one of the nation’s largest food manufacturers of horseradish products. T.W. Garner Food Company, located in Winston-Salem, North Carolina, is known for manufacturing a diverse portfolio of food products, including Texas Pete hot sauce.

Our two clients currently spend $36,000 a year to remove a combined 500 tons of byproduct waste and are interested in repurposing the waste to turn this cost into a profit. Our clients have hypothesized that their byproduct wastes could be effective as deer repellents. We were tasked with conducting further research to test this hypothesis. This consisted of field-testing the byproducts to measure their effectiveness as deer repellents and an industry analysis to determine whether there was a meaningful market for deer repellents.

**Contributions and Recommendations**

To determine whether our client byproducts were feasible deer repellents, we conducted field-testing using the byproducts as repellents. First, we chemically extracted the active ingredient from each byproduct. We coated deer feed with the extract and set up test sites in a residential area known for significant deer browsing. Deer visit times and feed consumption at each repellent site were analyzed using recorded video footage. Both repellents performed as effectively as the leading commercial repellent (Liquid Fence) in deterring deer browsing. Meaningful feed consumption was found only at the test site with no repellent added. These test results demonstrated the feasibility of using both byproducts as deer repellents. Thus, we recommend that our clients pursue commercialization of their byproducts. In addition, market research indicated that there is an unmet need for deer repellents. Moving forward, we suggest that our clients conduct further field-testing to optimize repellent concentrations and delivery methods. We estimate a 3 to 5 million dollar annual revenue from our clients’ expected repellent production.
Client Backgrounds

Tulkoff Food Products, Inc. is a family business that was first established in Baltimore, Maryland and is recognized as one of the nation’s largest food manufacturers of horseradish products.

T.W. Garner Food Company produces Texas Pete Hot Sauce in Winston-Salem, North Carolina. The hot sauce was introduced in 1929 by Sam Garner, and accounts for almost 8% of the total US hot sauce market.

Opportunity

Evaluate the feasibility of repurposing our clients’ byproduct waste as a deer repellent

- Tulkoff
  - 100 tons
  - $9,000
- TW Garner
  - 400 tons
  - $30,000

Annual client waste weight and disposal costs

$7.7 Million in crop damage in Maryland due to deer eaten

$410,000 spent on preventative measures

Potential Impact

Estimated annual revenue based on expected repellent production ranges from $3,000,000 to $5,000,000

Recommendations

Moving Forward

1. We recommend Tulkoff and TW Garner continue testing byproducts as deer repellents
2. Field testing shows effectiveness comparable to commercial products
3. Market research indicates an unmet need regarding deer repellents
4. Clients have low cost to enter deer repellent market

Methodology

Step 1: Isolation of byproduct active ingredient
- Horseradish
- Pepper
- Alyl isothiocyanate
- Capsaicin

Step 2: We concentrated active ingredient with deer feed

Step 3: Set up test sites in residential area which experiences multiple deer visits per day

Step 4: Capture video footage of deer visits

Data

Reproducts decreased deer visit time as much as commercial repellent

Step 5: We have verified the feasibility of our clients’ byproduct as deer repellent

Contributors:
- Dr. & Mrs. Nathanson
- Dr. Farid Karbali
- Dr. Bruce Kendal
- The GUBDP Community
- State Wildlife Services
- Maryland State Wildlife Services

Artemis Solutions

Deer Repellent from Waste Product:
“Byproduct” to “Buy Product”

Project Champions:
- Phi Tulkoff
- Gerald Lambert
- Brent Gauden

Faculty Advisor: David Ashley

Source: Maryland State Wildlife Services
**THE QUEST - TULKOFF FOOD PRODUCTS PROJECT**

**IMPROVING QUALITY LAB EFFICIENCY**

**QUEST STUDENT TEAM: TAKEOFF CONSULTING**

<table>
<thead>
<tr>
<th>Eric Bailey</th>
<th>Nicole Blahut</th>
<th>Camille Boustani</th>
<th>Hannah Breakstone</th>
<th>Sam Ebert-Zavos</th>
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<tbody>
<tr>
<td>Materials Science &amp; Engineering</td>
<td>Operations Management and Supply Chain Management</td>
<td>Neurobiology and Physiology</td>
<td>Supply Chain Management &amp; International Business</td>
<td>Bioengineering</td>
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<tr>
<td>Rose Albrecht</td>
<td>Dr. Pamela Armstrong</td>
</tr>
<tr>
<td>Quality Systems Manager</td>
<td>Clinical Associate Professor, Management Science</td>
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**PROJECT SCOPE**

Tulkoff Food Products, Inc. is a family-owned business headquartered in Baltimore, Maryland that manufactures condiments, sauces and dressings with core ingredients consisting of horseradish, garlic, shallots, and ginger. Tulkoff started as a manufacturer of horseradish and, almost 80 years later, manufactures nearly 40 products on four different lines and has opened an additional manufacturing facility in Pittsburg, California. Tulkoff is committed to providing safe and high quality products to its customers.

Tulkoff has a quality assurance lab on site that tests products at multiple stages to ensure food safety. Production halts during testing and resumes once that particular product passes every required test. Currently, average testing time is 10-15 minutes, during which production workers return to the quality lab an average of three times to check product status; communication is only available via face-to-face interaction. Takeoff Consulting worked with Tulkoff’s Quality Systems Manager to decrease testing throughput time and improve communication between lab technicians and production workers to ultimately increase productivity on the floor.

**CONTRIBUTIONS AND RECOMMENDATIONS**

Takeoff Consulting conducted interviews with employees and completed statistical analyses of correlations between products and test requirements. Based on Takeoff Consulting’s observations, production workers return to the lab to physically check if samples have completed testing an average of three times per sample. By implementing a visual communication system where production workers can see their sample’s testing status on a screen at their workstations, they only need to travel to the lab to deliver samples. Through changes in lab equipment, including replacement of current tools with automated versions, there is opportunity to decrease testing time and increase accuracy. It is also recommended that samples be approved for next steps in the batching process prior to passing the drain weight test, which was identified as a significant bottleneck. The occurrence of failure of a drain weight test is so low that it will not negatively impact production.
QUEST Faculty and Leadership

Dr. Pamela Armstrong
Clinical Associate Professor of Management Science
Robert H. Smith School of Business
Projects Advised: Bowles Fluidics, Tulkoff Quality Control

Pamela Armstrong is a Clinical Associate Professor in the Decision, Operations and Information Technologies department at the Smith School. She teaches the introductory QUEST course on design and quality and the QUEST mentors course, as well as courses in operations management, operations strategy, decision analytics and project management at the Smith School. Her areas of interest include quality, performance excellence, and service operations. Prior to joining the Smith School, Dr. Armstrong ran a management consulting firm that provided operational analysis, strategic planning, and performance management services to federal clients. Before consulting, she served on the faculty at Georgetown University’s McDonough School of Business. Dr. Armstrong has also worked as an engineer at IBM, AT&T Bell Laboratories, and Hughes Aircraft Company. She earned her Ph.D. in Operations and Information Management at the Wharton School of the University of Pennsylvania, her M.S. in Operations Research and Industrial Engineering from the University of California, Berkeley, and her B.S. in Systems Engineering from the University of Arizona.

David Ashley, M.B.A.
Executive In Residence, QUEST Honors Program
Robert H. Smith School Of Business
Projects Advised: Tulkoff Deer Repellent

David Ashley is an adjunct professor and an Executive in Residence at the University of Maryland’s Smith School of Business. He is currently the Human Capital Data Analytics Division Manager at the Department of Homeland Security. Before his current role at DHS, he was a program analyst for the Federal Emergency Management Agency (FEMA) within the Department of Homeland Security. Before joining FEMA, Professor Ashley also worked at the Department of Homeland Security, Customs and Border Protection (CBP), the U.S. Small Business Administration (SBA), and the Small Business Development Center at the University of New Mexico. Additionally, he served as president of the University of Georgia’s Marketing Research Institute International and he served two terms as president of the Mid-Atlantic Chapter of the Marketing Research Association. Professor Ashley has many publications including a marketing research college textbook published by Kendall Hunt Publishing. He holds an undergraduate degree from the University of North Carolina and a graduate degree from the University of New Mexico.
**Dr. Joseph P. Bailey**  
**Research Associate Professor of Decisions, Operations & Information Technologies**  
**Robert H. Smith School of Business**  
**Projects Advised: ATK B&P Change Management**

Joseph Bailey has been a faculty member at the Smith School since 1998. In addition to advising one team of QUEST students this semester, he directs and teaches in the QUEST-inspired MBA program mQuest. Dr. Bailey also teaches in the Smith School’s Executive Program including a class on Strategic Information Systems in the EMBA program. He is spending the year at the United States Patent and Trademark Office as an Edison Scholar doing research on the use of machine learning to uncover better prior art during patent application examination. Dr. Bailey has numerous peer-reviewed publications and was co-editor of the book “Internet Economics” from MIT Press. He has a Ph.D. from the Technology, Management and Policy Program at MIT, an M.S. in Engineering-Economic Systems from Stanford University, and a B.S. in Electrical Engineering and Engineering and Public Policy from Carnegie Mellon University.

**Dr. Nicole M. Coomber**  
**Undergraduate Management Major Coordinator, Management & Organization Department**  
**Robert H. Smith School of Business**  
**Projects Advised: PwC**

Nicole Coomber completed her PhD in Education Policy and Leadership in May of 2012 at the University of Maryland’s College of Education. She teaches organizational behavior, management consulting, and cross-cultural management, and her research focus is management education and curriculum design. Nicole is currently the undergraduate management major coordinator for the Management & Organization department and serves as affiliated faculty to the QUEST Honors Program. Before joining the faculty at Smith, she worked with the QUEST program as Assistant Director, leading efforts in curriculum and corporate development.
Jeffrey Herrmann is an Associate Professor at the University of Maryland, where he holds a joint appointment with the Department of Mechanical Engineering and the Institute for Systems Research. Dr. Herrmann earned his B.S. in Applied Mathematics from Georgia Institute of Technology. As a National Science Foundation Graduate Research Fellow from 1990 to 1993, he received his Ph.D. in industrial and systems engineering from the University of Florida. His dissertation investigated production scheduling problems motivated by semiconductor manufacturing. He held a post-doctoral research position in the Institute for Systems Research from 1993 to 1995. His current research interests include operations research for homeland security and emergency preparedness, production scheduling, and improving decision-making processes.

Hassan Ibrahim is a Clinical Professor at the Robert H. Smith School of Business. Dr. Ibrahim received his Doctor of Science (D.Sc.) and Masters in Engineering Management from The George Washington University. He also holds a Bachelor degree in Electrical Engineering. Dr. Ibrahim’s areas of specializations include Project Management, Information Systems Development, and Operations Strategy. Dr. Ibrahim’s research was published by Harvard Business School and the Production and Inventory Control Journal. Ibrahim served on the Editorial Review Board of the Journal of Operations Management. His primary teaching areas are: Project Management, Information Systems Analysis and Design, Data Communications, and Operations Management. He was nominated for the Outstanding Scholar of the Year Award in the Commonwealth of Virginia in 1996. Dr. Ibrahim is a twice recipient of both the Philip Merrill Award and the prestigious Krowe teaching Excellence Award. He has worked for and consulted with a number of industry leaders including the World Bank, McDonnell Douglas, Phillips Electronics, Hughes Networks Systems, and Siemens Medical Systems.
Kylie Goodell King, M.A.
Program Director, QUEST Honors Program

Kylie King is QUEST’s Program Director and a co-instructor for BMGT/ENES 490H. Kylie teaches a related course, Defining Consulting and Innovation Projects, where she works with students to identify QUEST clients and outline capstone projects. She is also leading a course about design and innovation in Silicon Valley in Spring 2015. In addition to teaching, Kylie manages QUEST’s program operations, including learning outcomes assessment, program marketing, and alumni relations. Kylie is currently pursuing a Ph.D. in Quantitative Methodology in Maryland’s College of Education. Her research interests include evaluating admission metrics and outcomes of high-achieving student programs. Previously, Kylie served as an assistant director and graduate assistant with QUEST while earning her MA in higher education at the University of Maryland. Before joining QUEST, she received a BS in industrial and systems engineering from North Carolina State University and worked as an Industrial Engineer in the Tyco Electronics Leadership Development Program.

Jessica Macklin, M.A.
Program Coordinator, QUEST Honors Program

Jessica Macklin is QUEST’s Program Coordinator. In this role, she coordinates QUEST’s daily operations, including assisting with recruitment and admissions efforts, planning orientations and conferences, and advising student organizations. Jessica received her BA in Psychology from the University of Maryland, College Park and her MA in Higher and Postsecondary Education from Teachers College, Columbia University. She remains an active member of the Teachers College National Research Team on College Educational Quality. Prior to joining QUEST, Jessica was the Graduate Assistant in Columbia University’s Office of Student Engagement.
**DR. MICHAEL OHADI**
Professor, Mechanical Engineering Department
A. James Clark School of Engineering
Projects Advised: Lutron

Michael Ohadi is a professor of mechanical engineering, co-founder of the Center for Environmental Energy Engineering, and Director of the Smart and Small Thermal Systems Laboratory at the University of Maryland, College Park. He received his Ph.D. in mechanical engineering from the University of Minnesota in 1986. His areas of research include heat/mass transfer enhancement; advanced energy systems, and building energy audit/control/modeling. He is a fellow member of both ASME and ASHRAE. He is the inventor/co-inventor of eight issued U.S. patents and has published more than 200 refereed technical publications, and is the recipient of numerous awards in recognition of his work.

**DR. JAMES PURTILIO**
Associate Professor, Computer Science Department
College of Computer, Mathematical, and Natural Sciences
Projects Advised: Appian, AT&T

James Purtilo specializes in software development and product assurance, and his research is currently funded by the Office of Naval Research on a cyber security systems project. With prior support from the National Science Foundation, Department of Defense Advanced Research Projects Agency and various corporate sources, Purtilo has studied and published on topics of software producibility, formal methods, rapid prototyping and testing. Purtilo has served on the Defense Biometric Support Team (an advisory group to the Office of the Secretary of Defense), is a member of the Arrhythmia and Cardiology Imaging Group at the UM Medical Center in Baltimore, and has consulted with the Division of Civil Rights within the Department of Justice. At the University of Maryland, he has served as the Associate Dean for Undergraduate Education in the College of Computer, Mathematical and Physical Sciences, chaired the undergraduate Computer Science program and directed the Master’s of Software Engineering Program. He received his Ph.D. in Computer Science from the University of Illinois at Urbana in 1986.
**Dr. J. Gerald Suarez**  
**Professor of Practice in Systems Thinking and Design**  
**Fellow, Center for Leadership, Innovation and Change**  
**Senior Executive Coach**  
**Robert H. Smith School of Business**

J. Gerald Suarez is a premier educator, speaker and consultant in the fields of Organizational Design, Systems Thinking and Total Quality Management. He joined Smith in 2005 as Executive Director of the multidisciplinary Quality Enhancement Systems and Teams (QUEST) Honors program. Dr. Suarez currently teaches the required QUEST class on “Systems Thinking for Managerial Decisions.” Additionally, he teaches at the corporate, executive MBA, custom EMBA, international, and undergraduate levels. From 2008 to 2010 Dr. Suarez served as Associate Dean of External Strategy, leading the offices of marketing communications, recruitment and career services. Prior to joining the Smith School, he served under two administrations in the White House as the Director of Presidential Quality. Dr. Suarez holds a master’s degree and a Ph.D. in Industrial-Organizational Psychology from the University of Puerto Rico.

**Dr. Monifa Vaughn-Cooke**  
**Assistant Professor, Mechanical Engineering Department**  
**A. James Clark School of Engineering**  
**Projects Advised: Baked by Yael**

Monifa Vaughn-Cooke joined the University of Maryland, College Park in 2012. Her M.S. degree focused on human factors and medical device design and her Ph.D. focused on the application of human reliability tools to the healthcare system. Dr. Vaughn-Cooke’s interdisciplinary research synthesizes sociology, psychology, systems engineering and risk assessment. Her research aims to identify the behavioral mechanisms associated with system risk propagation to inform the design of user-centric products and systems, with the ultimate goal of improving productivity and safety.
NOTABLE PAST PROJECTS (2010-2013)

2013: THE QUEST – SPECTRUM FOODS PROJECT

PROJECT: WAREHOUSE OPTIMIZATION

Elinor Chang
Ehson Kashfipour
Danny Laurence
Melinda Pandiangan
Olivia Sulaeman

PROJECT SUMMARY

Spectrum Foods is a poultry, meat, and food service distributor founded in 1989. Located in Landover, MD, the company mainly services average-to-low cost ethnic grocery stores, restaurants, and wholesalers in the Mid-Atlantic region. In recent years, Spectrum Foods has experienced exponential growth and generated upwards of $70 million in sales. Spectrum’s differentiating factors are flexibility, convenience, and an overall customer-oriented approach to business operations. Our client was looking to assess opportunities to optimize the capacity of their current warehouse. Our team’s primary goal has been to explore and determine the most feasible and effective methods for maximizing storage capacity and minimizing holding costs, both in the short- and long-term. Allowing for an increase in capacity would strategically position our client for future growth opportunities. Moreover, it would allow Spectrum Foods to reduce its internal and external holding costs, take on additional business, and lay the foundation for future expansion.

CONTRIBUTIONS AND RECOMMENDATIONS

To position our client for continued growth, our team recommends the elimination of unprofitable items, the reduction of excess inventory levels, and the implementation of a racking system. Specifically, we recommend eliminating approximately 90% of the product offerings with monthly sales of under 5 cases per month and/or that generate under $50 per month in profits. In addition, we have compared each item’s average inventory holdings to an optimal level for that item, based on demand and variation in demand, and recommend a reduction in inventory levels for 62 product offerings. Lastly, our team has designed a racking system for the dry goods space of the warehouse which will add an additional 32 pallet spaces by early 2014. These three strategies together would result in a total annual opportunity cost savings of nearly $700,000.
2013: THE QUEST – UNILEVER PROJECT

PROJECT: OPTIMIZING OUTBOUND SHIPMENT PROCESS

Mackenzie Cooper
Eric Hamel
Aditya Sridhar
Aaron Tucker

PROJECT SUMMARY

Unilever is a British-Dutch multinational corporation behind many of the world’s most widely acknowledged consumer product brands collectively used by over 2 billion people daily. Among the extensive range of Unilever’s food brands, the Baltimore Spreads and Dressings Site is one of three facilities that manufactures popular spreads including Country Crock, Promise, and I Can’t Believe It’s Not Butter for distribution across the United States. Since the closure of a similar facility in Atlanta, Unilever Baltimore’s demand has increased by 40% from shipping 700 to 1000 pallets daily. Outbound shipment turnover time has consequently increased by 15% to 135 minutes. Due to limited warehouse capacity, additional inventory is interfering with inbound and outbound flow of goods which is detrimental to on-time delivery. In order to successfully meet demand, accommodate increased shipments, and boost dock schedule compliance, our team is tasked with reducing the average outbound shipment turnover time to 90 minutes.

CONTRIBUTIONS AND RECOMMENDATIONS

Through statistical analysis of loading durations and process mapping, our team concluded that shipments containing orders that request fewer cases than provided on a full pallet inflate average loading time by 50 minutes. We determined that individual partial pallet orders take three times longer to load than full pallet orders. Because partial pallets are consolidated in a reserved area of the warehouse through a process called Pick Line, we recommend that a partial order staging process occur so that loading partial orders entails the same process as full orders. In accordance with in-depth interview feedback from loaders and implementation trials, Pick Line 2.0 requires 4 additional casepickers and 2 additional forklift operator to stage all partial orders two shifts prior to truck arrival. Coordinated with our proposed rollout plan, stock replenishment process by prioritized SKUs, and implementation of 5S standards in a specified casepicking warehouse area, Unilever Baltimore would experience a 36% reduction in average shipment loading duration to 85 minutes. By freeing the dock schedule for an estimated 9 more trucks per day, this site can generate an additional $62 million in net sales within one year.
2012: THE QUEST – ATK Project

Project: A New Model for Mergers and Acquisitions

Mathew Gold
Amy Kalowitz
Santiago Miret
Melinda Song
Dulany Wagner

Project Summary
Revenue growth for companies can occur in two ways; organically, through product or service sales, and inorganically, through mergers & acquisitions (M&A) transactions. In M&A transactions, corporate valuation models are essential tools that help the involved parties make informed decisions. These models evaluate and predict the financial well being of an entity that would result from a merger or acquisition. Current valuation techniques at ATK require the creation of a new model for each deal, and extensive training for them to be used effectively. This inefficient process can delay important decisions and create unnecessary workloads. In our project, we have created an intuitive model that integrates standardized information to output unique valuation metrics and summarizes important information for enhanced decision-making.

Contributions and Recommendations
We have developed a Microsoft Excel-based valuation model that analyzes financial information from the Bloomberg database. Following the input of standardized financial statements, which is as simple as copying and pasting information from Bloomberg, the model then integrates the information into prepared financial statements and valuation methods. Our model includes a comprehensive instructions page for new users and is color-coded for intuitiveness. We have also included an output page that graphically summarizes desired information using intuitive graphical tools and tables that can easily be copied into presentations for further discussion. Our model will allow our client to make more informed decisions about mergers & acquisition transactions in a faster and more effective manner.
2012: THE QUEST – TULKOFF FOOD PRODUCTS PROJECT

PROJECT: PRODUCTION SCHEDULING

Becca Brown
Shirley Qin
David Rosen
Neal Yaffe
Nick Yaraghi

PROJECT SUMMARY

Tulkoff Food Products Inc. is a food manufacturing company, specializing in horseradish and garlic based sauces. Tulkoff Food Products Inc. serves a wide range of customers through the packing, retail, food service, and industrial markets.

Tulkoff Food Products presented the need for an increase in output per unit time (efficiency) of their production process. Specifically, the team was asked to look into the production scheduling process as a possible source for increased efficiency. For one of their manufacturing lines, the team worked to formulate a scheduling algorithm that would decrease the amount of overall changeovers, maximize run sizes, and ultimately accomplish the goal of increasing efficiency. Through situational research, statistical analysis, and trial runs, we were able to formulate a plan for improvement and move Tulkoff Food Products in the direction of increased efficiency for the future.

CONTRIBUTIONS AND RECOMMENDATIONS

Based on research, the team discovered that Tulkoff Food Products currently produces 47% of their maximum theoretical output. The team also found that the average number of daily changeovers was extremely high. From this data, the team was able to analyze the high moving SKUs that were responsible for 75% of overall production. This information led the team to develop an algorithm that would allow Tulkoff Food Products to focus on creating days in which the High Moving SKUS would be produced with greater run sizes, leading to a decrease in overall changeovers. The algorithm suggests two days a week that are dedicated to high moving SKUS. Also, the implementation of forward thinking in scheduling allows Tulkoff Food Inc. to use current open inventory capacity to allow for more efficient scheduling and use of the production lines.
2011: THE QUEST – SAIC MACHINE READING PROJECT

PROJECT: A.I. PREDICTION OF FINANCIAL CRISIS

Shiran Beroukhim
Jason Felder
Jeff Jacobs
Ryan Murphy
Avi Prince

PROJECT SUMMARY

SAIC is a FORTUNE 500 scientific, engineering, and technology applications company headquartered in McLean, Virginia. SAIC has over 45,000 employees and offers services in national security, energy and the environment, critical infrastructure, and health. As a leading provider of IT solutions services for all layers of the modern enterprise, from enterprise strategy consulting to managed infrastructure services, SAIC's IT experts are helping global enterprises every day cope successfully with today's competitive realities and challenges.

Our team is working synergistically with the DARPA Machine Reading Program at SAIC to investigate whether an analysis of ideas within financial news articles can allow for a better categorization than an analysis of words. In particular, we are exploring whether a machine can grasp the underlying ideas presented in an article and use them to predict an impending financial crisis. If such a system could be developed, international finance analysts could use it to gauge the current and future safety of a nation's economy.

CONTRIBUTIONS AND RECOMMENDATIONS

To achieve the ideal article categorization process, we have created a novel method for encoding ideas in the articles in such a way that a machine can learn and draw conclusions from it. In addition, we have developed an experimental procedure allowing us to compare the efficacy of our idea-based analysis against a word-based analysis. This procedure takes advantage of our "gold standard", the results of human categorization of the articles. Based on a comparison between the two methods' results and "gold standard", the effectiveness of the algorithms can be quantified.
2011: THE QUEST – Bowles Fluidics Project

**PROJECT: OPTIMIZING PACKAGING FOR INTERNAL SHIPPING PROCESS**

Phil Anderson
Kate Hartinger
Aaron Pearl
Aparna Rao
Saul Shamash

**PROJECT SUMMARY**

Bowles Fluidics is a fluid distribution products manufacturer that operates out of two main facilities to meet their customers’ demands: one for manufacturing the individual components of the products, and the other to assemble these components into finished products. This requires internally shipping over 200 tons of product per year, which forces even small inefficiencies to quickly add up both from a financial and environmental perspective. By moving from the current disposable boxes for internal shipping to reusable containers, Bowles can potentially save a substantial amount of money and reduce their waste production. We sought to determine the most optimal shipping container for Bowles’s current internal shipping.

**CONTRIBUTIONS AND RECOMMENDATIONS**

Our team has researched three packaging alternatives for Bowles’s internal supply chain: corrugated plastic, double-walled cardboard, and nesting plastic. We have determined that the optimal alternative is corrugated plastic. In today’s economy, reducing cost is an increasingly difficult necessity. From an economic perspective, the corrugated plastic option will save Bowles 44.7% on the internal shipping packaging cost. This option will cost $0.63 per trip, compared to the current single use cardboard cost of $1.14 per trip, saving Bowles $0.51 per box per trip. From an environmental perspective, the corrugated plastic option will reduce their shipping waste by 96% over a ten-year period, from 156 tons down to 6 tons.
2010: THE QUEST – TULKOFF FOOD PRODUCTS PROJECT

PROJECT: WASTE REDUCTION & WATER TREATMENT OPTIMIZATION

Jeffrey Lue
Yasmeen Thomé
Augusto Tono
Melanie Wong
Jesse Wu

PROJECT SUMMARY
Established in the 1930s, Tulkoff Food Products, Inc. provides kitchens with quality condiments, sauces, and spreads. Tulkoff is most famous for their horseradish sauces and prides itself on state-of-the-art facilities. Tulkoff strives to demonstrate environmental responsibility during their complex manufacturing processes. Tulkoff Food Products processes over two million pounds of horseradish annually. As a result, Tulkoff spends $100,000 to send nearly 250,000 pounds of peels, dirt, and sludge waste to a landfill each year. Tulkoff seeks to reduce waste management and water treatment costs, while addressing environmental sustainability. The team’s opportunity was two-fold: finding market demands for their waste products and optimizing their water treatment process.

CONTRIBUTIONS AND RECOMMENDATIONS
Our team recommends a partnership with a local composting company and the installation of a decanter centrifuge system. In addition to saving 700,000 gallons of water annually and creating a zero-waste business model, these recommendations will save Tulkoff approximately $65,000 each year. These recommendations allow Tulkoff to better align with their environmental initiatives. The team created a detailed business plan that includes implementation analyses, comprehensive cost models, and industry contacts.
**Project Sponsors 2014**

The companies below have made significant contributions to our students as they completed their capstone learning projects. In addition to financial contributions, these sponsors have given enormous amounts of time and thought leadership to our student teams.
QUEST would like to thank and acknowledge all of the individuals, committees, and organizations who have contributed to this event.

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- Shirley Han (Q19)

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- Dakia Adams, Kelley McKutchin

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- Cassandra Klemish

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- The Chef’s Table

**Dessert**
- Baked By Yael

**Photography/Videoography**
- Kiati Plooks Photography

**Student Volunteer Committee**

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