Ergo Cup® Teams

The internationally recognized **Ergo Cup**® competition, sponsored by the Ergonomics Center of North Carolina and Edward P. Fitts Department of Industrial and Systems Engineering at North Carolina State University and presented by IISE, provides an exciting opportunity for companies to highlight their successful ergonomic solutions. The general theme across all **Ergo Cup**® categories is innovation.

The goal of this competition is to recognize and encourage the development of innovative ergonomics solutions and education in the workplace. Any organization that can demonstrate an effective ergonomics solution or education initiative within the last 24 months (October 2016 – 2018) is eligible to compete. The ergonomic solution preferably should have been implemented at least 1 (one) full year and actual productivity, quality, and/or safety ROI results should be presented.

Five Ergo Cup® awards are presented annually for outstanding solutions through training, engineering and teamwork.

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Teams are listed below by category

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Booth # 708
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Lockheed Martin Space
Littleton, Colorado

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Standard Ergonomic Evaluation Process
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Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)

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Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)

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Facilities Maintenance Mechanics "Lifting the Lid"
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Booth # 509
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The Timken Company – New Philadelphia
Precision Bearing Plant
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Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)

Booth # 600
Flow Rack Flow Control
Toyota Motor Manufacturing Indiana
Princeton, IN

Booth # 601
The Janny Tool
Bridgestone Warren County
Morrison, TN

Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)

Booth # 602
Karakuri Frame Trolley
Toyota Motor Manufacturing Canada
Woodstock, Ontario, Canada

Booth # 603
Automatic Fabric Puller
Cintas Corporation
La Ceiba, Honduras

Booth # 604
Push-It-Pin (PIP)
Toyota Motor Manufacturing Kentucky
Georgetown, KY

Booth # 605
Hospital Scrubs Ergo-Buggy
Cintas, Location - 258
Lawrenceville, GA

Booth # 606
The Pup (IP Line Kit)
Toyota Motor Manufacturing Kentucky
Georgetown, KY

Booth # 607
Flywheel Coupling Lift Adapter
Cummins Technical Center
Columbus, IN

Booth # 608
3D Printed Self Lubrication Rail system
Toyota Motor Manufacturing, TX, Inc.
San Antonio, TX

Booth # 609
RotoErgo - Improving Ergonomics in Roof Sub Assembly
Cummins Power Generation
Fridley, MN

Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)

Booth # 610
SaraSara
Toyota Motor Manufacturing, TX, Inc.
San Antonio, TX

Booth # 611
Credenza Monitor Lift
Gulfstream Aerospace Corp.
Appleton, WI

Booth # 700
The Pit Crew
Honda of America Mfg.
East Liberty, OH

Booth # 702
"Stuck On You" - Magnetic Part Separation
Honda of Canada Mfg.
Alliston, Ontario, Canada

Booth # 704
Weightless High Torque Motor Application for F-35 Vertical Tails Installation
Lockheed Martin Aeronautics Company
Fort Worth, TX

Workplace Solutions I (Team-Driven Workplace Solutions)
Booth # 401
Radome A.I.R. (Articulating Internal Repair) Tooling
Delta Air Lines Technical Operation Center
Atlanta, GA

Booth # 403
New Twist to an Old Problem: Deburring 1.540 Rods
ATI, Huntsville, AL

Booth # 405
D-Container Improvements
Estée Lauder Logistics AG
Brunegg, Switzerland

Booth # 407
Bulk Supply Hole Covers
Estée Lauder Companies
Oevel, Belgium

Booth # 409
Lipstick Mass Cutter
Estée Lauder Companies
Oevel, Belgium

Workplace Solutions I (Team-Driven Workplace Solutions)

Booth # 411
Power Prime Pump
Estée Lauder Companies
Petersfield, Hampshire, United Kingdom

Booth # 413
Mass Cutting Device
The Estée Lauder Companies
Markham, Ontario, Canada

Booth # 415
Stepanquat GA-90 (Ammonyx) Handling
Estée Lauder Companies - Aveda Corporation
Blaine, MN

Workplace Solutions I (Team-Driven Workplace Solutions)

Booth # 417
Radar Love
Honda Manufacturing of Indiana, LLC
Greensburg, IN

Booth # 419
Knuckle Cart
Honda of South Carolina
Timmonsville, SC

Booth # 421
Pack Crate Fixture
Honda of South Carolina
Timmonsville, SC

Booth # 423
THAAD Missile Canister Shock Isolator Compression Tool
Lockheed Martin Missiles and Fire Control
Camden, AR

Booth # 425
B.R.A.T (Bearing Removal Assistance Tool)
Mercury Marine Plant 15 Assembly
Fond du Lac, WI

Booth # 427
Electric Arc Furnace Tap Hole Sanding
Nucor Steel Gallatin
Ghent, KY

Booth # 429
Chair Hauler
Wegmans Food Markets
Rochester, NY

Workplace Solutions II (Engineering/Ergonomist-Driven Workplace Solutions with internal competitions)
Booth # 422
The Mold Changers
Honda of America Mfg. Inc.
Marysville, OH

Booth # 424
The Fifth Element Filter
Honda Transmission Mfg.
Russells Point, OH

Booth # 426
Harness Installation Hooks and Spool
Sikorsky Aircraft Corporation
Stratford, CT

Booth # 428
FA Light Weight Drill Jig Lifting
PPG Aerospace
Sylmar, CA

Booth # 430
Batwing
Toyota Motor Manufacturing, TX, Inc.
San Antonio, TX

Booth # 431
Fuel Line Vibration Isolator Pliers
Cummins Inc. - Jamestown Engine Plant
Lakewood, NY

Booth # 432
Engine Pick End Effectors
Toyota Motor Manufacturing, TX, Inc.
San Antonio, TX

Workplace Solutions II (Engineering/Ergonomist-Driven Workplace Solutions)
Booth # 400
Auto-Bagger Easy Release Pole
Estée Lauder Companies Inc.
Bristol, PA

Booth # 402
Low Weight Recovery System
Estée Lauder Companies - Aveda Corporation
Blaine, MN

Full Team Information

Ergonomics Program Improvement Initiatives
Booth # 708
Effectively Leveraging Virtual Reality to Enhance Ergonomics Integration
Lockheed Martin Space
Littleton, Colorado

Presentation Description: The CHIL developed a virtual reality (VR) environment that allows users to perform immersive, real-time ergonomic studies. The user can connect and interact with other VR users from around the world to analyze a design or production operation. The system is portable and can be setup using a laptop and VR headset in a few minutes. The ability to check reach access, assess complicated postures, and execute manufacturing operations has never been more affordable, available and easy to use.

Problem: The Collaborative Human Immersive Laboratory (CHIL) is a VR lab tasked with creating simulations of manufacturing operations and performing low-level ergonomic studies to validate the procedure. These simulations previously used the manikin posturing features within CAD software, which can be a tedious process depending on the number of manikins and level of detail required. Though anthropometrically accurate, these simulations are solely reliant on the assumptions made by the simulation engineers and provide no feedback as to the induced fatigue, discomfort or difficulty of such postures. Previous methods of performing these virtual studies were accompanied by lengthy and cumbersome setup procedures, low resolution graphics and minimal interaction with the environment.

Solution: The CHIL developed a means of performing the same studies in a full-scale, 3D VR environment by leveraging the motion tracking technology of inexpensive ($1000) commercial products. We can perform real-time ergonomic studies on any LM program model using a VR headset, two handheld controllers and three body trackers. Once setup, a person, or persons, join a virtual world as a full-body avatar and carry out the action first-hand. These studies have proven to be more beneficial to the simulation engineers, design engineers, technicians and program managers due to the added feedback gained by people physically performing the movements in a virtual environment. The CHIL's solution is more efficient, more informative and much simpler than previous methods.

Measurable Outcomes: The CHIL provides ergonomic analysis capabilities used throughout Lockheed Martin Corporation. The ergonomic studies reduce, and in many cases eliminate, personnel safety risk by allowing technicians to simulate and perform manufacturing and production operations on a virtual build. The technicians carry out these exercises months ahead of time to help identify and mitigate any problems that could arise on the shop floor during the actual operations. The CHIL has a multitude of examples for remove and replace scenarios in which various space programs used the CHIL's VR tool to eliminate all human factors issues and mechanical interferences. Performing the exercises virtually also reduces the risk of damaging key flight hardware components that cost in the millions of dollars.

In terms of quality, the technicians have transitioned from expensive physical mockups that require significant manpower and time investments to using full-scale, virtual representations of the spacecraft, mechanical ground support equipment and tooling. As a result, the technicians have days, weeks and sometimes months to prepare using the virtual build. The technicians consistently report the CHIL's VR tool as having a direct impact on the success of their operations. The technicians can lay down, sit, stand, crouch or otherwise position themselves to safely, effectively, and efficiently perform their task.

Depending on the specific issue, the CHIL has been credited with saving anywhere from three weeks to six months of manufacturing time. For lesser time savings, typically the solution is approximately known, but is practiced and refined using the virtual reality tool. In other more severe cases, the networked capability of the CHIL's VR tool allows technicians to collaborate and interact as a team to evaluate several possible solutions and select that which best suits their needs.

The CHIL's VR system saves just shy of $500k per year due to labor efficiency, few software licenses, and reduced hardware maintenance when compared to the previous, more expensive system comprised of a static $1M motion capture facility. With the new system, the CHIL can deploy a laptop and VR

headset, setup the equipment anywhere (i.e. conference room, cubicle, etc.) and perform studies in real-time with other users from around the globe.

Ergonomics Program Improvement Initiatives
Booth # 710
Standard Ergonomic Evaluation Process
Navistar International
Springfield, Ohio

Presentation Description: Navistar began an ergonomic assessment and solution program in 2015 to combat the significant work place injuries that occurred routinely. The program has evolved from perceived top-ten ergonomics issue list to a systematic process and standards that drive sustainable solutions This standardized process has contributed to ergonomics being a vital component of the plant culture. A systematic process requiring ergonomic evaluations and resolutions to issues has been established with participation from every level. The process is effective in identifying and solving ergonomic issues because there is involvement from every level.

Problem: Navistar's Springfield Assembly Plant had a significant injury rate related to ergonomic issues. There were minimal systems in place to evaluate or solve poorly designed manufacturing processes.

The Springfield Assembly plant builds a high volume of large commercial trucks. The plant manufactures a wide variability in product size, configuration, and components. These factors distinguish Navistar from its competitors and allows it to better compete in the marketplace. However, the lack of standardization often leads to awkward assembly processes that lead to preventable injuries and ergonomic issues.

Previously, ergonomics were mostly considered when employees complained, or injury rates coincided with specific jobs or tasks. Nearly all issues were given to the Safety Department to investigate and provide resolution. Ergonomics, lacking regulatory backing nor recognition of measurable productivity loss, did not often get management attention to provide true solutions on the active assembly lines. Individual safety mangers could offer low cost PPE or administrative controls, but were unable to secure additional input, process or work station changes, nor perceived costly engineering changes to eliminate an ergonomic hazard.

Prior to the company wide culture change around ergonomics there was no proactive process, resources, or funding to identify issues before an operator was injured. Ultimately there was a lack of ownership from the plant and corporation to eliminate ergonomic and safety concerns.

In 2015, the high rate of injury at the plants was determined to be unacceptable. As part of the initiative to reduce injuries the Vice President of Manufacturing challenged all of Navistar's manufacturing facilities to identify and remedy the top ten ergonomic issues. This request was the origin of a systematic program to identify and solve ergonomic issues.

Solution: The Springfield Assembly Plant started with a program initiative to identify and solve the top ergonomic issues. A committee with functional representatives including operators and UAW safety representation. A committee was formed to evaluate and solve the top 10 ergonomic issues in the plant. The committee was made up of representatives that had little background in evaluating ergonomics. The Springfield Assembly Plant started with no program initiative to identify and solve the top ergonomic issues. An upper-management driven program developed an ergonomics committee to evaluate all operations in the process. To start, there was no infrastructure to make this happen. Progress on the program was slow to start because the team was challenged to effectively identify, manage, and mitigate issues in the plant. To accomplish this, a system that shifted the culture needed to be implemented.

The concept was simple. Identify the perceived top ergonomic issues in the plant, assign a champion, solve the issue. The champion assigned to each issue on the list is responsible for reporting weekly updates, action plan, and timeline to the plant manager. An issue will stay on the list until it is solved. This process incorporates change management systems into the ergonomics issue identification and solution. The plant manager is responsible for reporting monthly to executive leadership.

The need for ergonomists in the plant was defined early in the program. Initially, the ergonomist utilized MURI analysis to evaluate the items qualitatively identified by the committee. The value to the ergonomic

evaluations was a significant improvement to preventative safety assessments. The plant migrated away from MURI analysis to utilizing E-Tools software so that efficiency in analysis could be increased. The E-Tools software classifies a process as high, medium or low risk. Any high-risk process was deemed unacceptable and needed to be solved. Eventually, all operations in the plant would be evaluated using the software. Furthermore, when an injury occurs that has an ergonomics component, the E-Tools score and evaluation is updated within 24-hours.

In order to evaluate all operations in the plant efficiently, more help would be needed. To aid in this task, industrial Engineers (IE's)—who were trained to perform ergonomic evaluations—were brought on board. The IE's were responsible for evaluating 5 operations per week.

Along with the E-tools assessment, issues can also be identified from operators and group leaders via continuous improvement cards. Continuous improvement cards are submitted by all levels within the organization and are reviewed weekly. The champion of a high-risk issue works with the operators, group leaders, safety, and supervisors to implement solutions that reduce the ergonomic risk. These processes have led to ownership from the bottom-up and geared the culture to be focused on safety and ergonomics.

A monthly plant safety review (PSR) was established with executive leadership. During PSR, the department level manager's responsible for reporting the action plan and timeline for the high-risk issues in their department. The reporting is done in a standard format throughout all Navistar assembly plants. This continuous reporting, accountability, and plant-owned process has led to a sustainable ergonomic improvement program.

Issue identification of old process have help shape the culture around safety and ergonomics. The champion for each issue is responsible for checking/updating all paperwork that goes along with that job. Updating the job paperwork ensures the solution is long-term. Along with evaluating current processes, all new process and man power initiatives undergo ergonomic evaluation prior to being released.

Top-down management support allowed for a systematic approach—and the infrastructure to support it—to be implemented. The wide involvement from all departments within the plant have led to an effective and sustainable process that help mitigate ergonomic concerns before they happen.

Measurable Outcomes: The Springfield Assembly Plant (SAP) has seen a decrease in injuries since the ergonomic program has been initiated. In 2014, SAP had an injury frequency rate (IFR) of 7.40 and a lost time case rate (LTCR) of 2.11. The year the ergonomics initiative began, 2015, the IFR was 5.03 and the LTCR was 0.81. In 2016, the plant added an additional assembly line; the IFR and LTCR increased this year due to the new line being implemented to 5.94 and 2.22 respectively. The year after the second assembly line was added, both numbers decreased to 3.37 (IFR) and 0.64 (LTCR).

Since the ergonomics program began in 2015, 421 operations have been evaluated. Of those, 150 were determined to be high risk issues via the E-Tools software. Furthermore, 120 have had permanent corrective actions implemented and 30 are in process of being mitigated.

Strap lock cutting was one of the first issues identified by the ergonomics committee. There were multiple recordable/loss time injuries. Some operations required cutting more than 200 strap locks per day. Providing tools that required less force and reducing the number of strap locks per operation resulted in increased safety, fewer injuries, and less payout due to lost time.

It took from 2015 when the program started, to 2016 to eliminate the high-risk assessment for all strap lock cutting operations During this time, there were 1.70 first aides per month and 0.58 recordable injuries per month. Since the new tools and limitations were implemented, there have been 0.75 first aides per month and 0 recordable injuries.

Strap locks are only one example of providing safer working conditions. Multiple lift assists have been provided to eliminate manual lifting. Material racks/presentation have been modified to be operator-friendly. Product engineering has made changes to make the manufacturing process safer. Operators are identifying issues before injuries occur. Multiple departments within the plan are working together to make the workplace safer.

Providing a safer work place correlates with increased quality. When operators are hurt less frequently, there is a lower turnover rate on the job. This means that new operators do not have to be trained on the job regularly.

Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)
Booth # 501
Multi-Tool Wizard
PPG Mojave
Mojave, CA

Presentation Description: Aerospace Coatings and Sealants manufacturing uses different container types from five-gallon pails to 55-gallon drums for raw materials and products shipped to customers. The various container closure bungs are as different as the container type and size. Some raw materials act as thread sealers, requiring tremendous force to break the bung free, using standard wrenches and bung tools. There have been past incidents where ergonomic injuries have occurred while struggling to open containers using standard hand tools. A new tool was needed that would adapt to any type of container closure and makes use of air powered wrenches.

Problem: The problem was to develop a tool that would interface with air driven wrenches, making the tool do the work not the employee, and was adaptable to any container closure device (bungs, lids, caps), making it universal and standardized. The tool had to be simple in design, easy to use and universal to all container closure types. The newly designed tool had to eliminate the ergonomic injury risk through use of a machine, rather than reducing or substituting the risk of injury through use of a different type of hand tool. In addition, the new tool had to be safe for use in a Class I Division I electrically hazardous classified area.

Solution: The concept for the solution was developed by Sealants manufacturing employee. He then solicited input for the design from fellow manufacturing employees and formed a team to develop prototypes of the tool. Through countless hours of trial and error, refinement of the various prototype tools, and collaborating with fellow manufacturing employees, his manager and the EHS manager, a solution was developed. The tool was originally fabricated in his garage and made of stainless steel. However, the team wanted to ensure that the tool was of non-sparking material of construction, simple, robust and truly universally adaptable to every container closure type used for our products. In addition, the solution can be used with air drivers as well as electrical/battery powered drivers.

Measurable Outcomes: Project Cost:
$50 to produce each tool (20 needed)
Total Project Cost = $1,000

Injury Savings:
2 incidents of finger or hand fracture
20% profit margin
Direct Cost = $101,556
Indirect Cost = $111,710
Total Cost = $213,266

Production Savings:
Additional Sales to Cover Costs of an Injury = $1,066,330

ROI = ($213,266 + $1,066,330)/$1,000 X 100 = 127,960%
Payback: ($213,266+$1,066,330)/12 = $106,633/month savings. $106,633/30 = $3,554 per day, or $148/minute for a total ROI of 6.8 minutes to payback the cost of 20 tools at $50 each.

Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)
Booth # 503

All Torqued Up: Hump Seal Lid "F" clamps
PPG Aerospace
Huntsville, AL

Presentation Description: The exterior seal (humpseal) installation process involves 14 ratchet clamps. The required clamping force was achieved by manually installing and tightening clamps.
Operators frequently complained of strain on their hands and wrists. Previously, no standard force was defined to achieve a humpseal within tolerance.

Problem: An engineered solution was created to eliminate manual hand-tightening while providing a standardized process. The manual operated portion of the clamp was replaced with a cordless torque-wrench driven closure. This eliminated over-extended hand gripping and repetitive motion of squeezing the clamp closed. The new clamps provide a more consistent force, ensuring quality of the product.

Solution:

- Ratchet style clamps were manually closed, causing frequent over-extended hand gripping as well as use of high force required for squeezing the clamp handles.
- When releasing the clamps, the retained force caused clamps to disengage in a forceful, abrupt manner – which could potentially injure the operator upon release.
- The cart used to hold the part during the clamping process was not at the proper ergonomic height for all operators & was not adjustable.
- Lack of consistent, standard process to secure lid to the window during the installation process
- Modified "F" shaped clamps using 12 mm deep sockets.
- Purchased Makita cordless torque wrench to apply torque using a power tool in place of previous hand tightening method.
- This eliminated all manual clamping processes to install lid.
- Eliminating the hand closure clamp removed the possibility for the clamp to "pop" open upon release.
- The modified clamps allowed for consistent force applied using the torque wrench, thus creating a higher quality part.
- The solution came about through experimenting with ideas from a cross-functional team of operators and technical support in Focus Factory 2.
- Other styles of manual clamps were also trialed but did not eliminate the ergonomic stressors of the task. The team came up with the idea of using a hand tool to close the clamps, thus the solution of a modified clamp that utilizes a socket closure.
- During the ergonomic assessment (EJMS), it was noticed that the workstation height was also not optimal, so a cart with adjustable height was brought to the work cell to use for this process.
- After working with the tool shop to modify the clamps, an experimental Process Change (EPC) was submitted to initiate samples for trialing the modified clamps on production units.
- 8 samples were tested and verified for dimensional criteria and met customer specifications.
- The process was adopted, and Standard Work updated to implement the new change
- One on one discussions with operators as well as team meetings to review feedback and additional ideas. Area Sustainability teams from both Focus Factory 1 and 2 also discussed the need and benefits of a new style of clamp.

The original manual clamping process involves multiple ergonomic red flags dealing with the hand, wrist and shoulder. These red flags included:

- Working with wrist bent, flexed or deviated
- Forceful exertion with the hands
- Hand grip span more than 4 inches
- Elbow extended outward from the side of the body

An EJMS – Force/Frequency assessment was completed & resulted in a high score of 75. After improvements were made the risk was removed and the score is now 0.

A red flag assessment was completed which resulted in a very high score of 4. After improvements were made the risk was removed and the new score is now 0.

The potential for ergonomic injuries to the hand, wrist and shoulder were eliminated.

Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)
Booth # 505
Cleaning of Stirrer Shafts and Cups
PPG Industries Lackfabrik GmbH
Bodelshausen, Germany

Presentation Description: Many of our coatings must be stirred, while they are filled in drums or pails. For quality purposes, the heavy stirrer shafts and stirrer cups (see pictures attached) of 2 filling stations must be cleaned several times per day, whenever we fill a different finished product. For that reason, they had to be removed manually from the stirrer and transported to the cleaning department. After the cleaning process, the same had to be done in the reverse order.
The aim of the project was to reduce the ergonomic risk, to minimize the exposure to solvent vapors and finally to reduce the waste of time.

Problem: The shaft and cups of each filling stirrer (see attached picture) have to be cleaned, whenever a different product must be filled. That is typically 5 times per day/stirrer. Before the project was implemented, the operator had to remove it manually, bring it to the cleaning area and after the cleaning process attach it again to the stirrer. The total weight of shaft and cups is 19,5 kg (43 lbs.). For mounting it, the shaft had to be held in one hand, while the other hand actuated the shaft coupling. In some cases, a second employee was necessary for support. We identified an elevated ergonomic risk for wrist, arms, shoulder and back. B) After removing the shaft from the stirrer, it had to be brought to the cleaning area and cleaned with solvent. Because of the length of the shaft it was not possible to clean it automatically and therefore a manual cleaning with organic solvent was necessary which caused emissions and exposure to the operator. C) The process as described above was time consuming.

Solution: The goal was to find a solution which covers all of the above-mentioned problems.

A team consisting of production, engineering and a PPG contract company, finally developed a mobile washing basin. We already used provisional basins in the past (such as a drum, filled with solvent) but these were not sufficient. The new stainless-steel basin now has the optimal size to fulfill its job. Based on the form, the stirring cups fit perfectly inside and the level of solvent in the basin can be kept as low as possible. This provides a first layer of protection against spills and in addition to that the weight of the basin provides easy maneuverability. The covers are made to enclose the shaft as much as possible, so that the evaporation of solvents is significantly minimized. The basin is equipped with holders for all necessary tools and the covers. In case the solvent must be released, the basin is equipped with a camlock coupling to attach a pump. The wheels are conductive to provide the risk of static discharges in classified areas. With this new method, it is no longer necessary to remove the shafts. Instead of that, the basin can be placed underneath the stirrer and then the shaft and cups are lowered to submerge in the solvent to soak for some minutes. During this the basin is well covered and nearly no vapors can escape. After a while, remaining residuals can be removed with a brush within a few seconds and the cleaning process is finished. There is no more ergo risk, the exposures to emissions are minimized and working time is significantly reduced because it is no longer necessary to transport the shaft in the cleaning department.

The washing basin as described, can be used at each facility where stirrer shafts/cups or agitator discs have to be cleaned. (more precisely, agitators for processing mobile vessels). It can be built by each qualified metal worker with good experience in welding. It can be adapted to the specific requirements of any manufacturing site. However, as already described above, if it is used in electric classified areas or used with flammable liquids, static electricity must be considered and therefore some measures (e.g. earthing connections and conductive wheels have to be attached). There is no energy source or electric equipment necessary. This affordable tool helps to positively influence three critical factors- ergonomics, emissions and waste of time.

After some interviews with our operators, we received only positive feedback mainly because of the reduction of the ergonomic issue. Meanwhile we have built similar smaller basins for other agitator types.

The new equipment is relatively low cost but brings high benefit. Before this ergo project was implemented, we identified the following risks for the former process: Bending of both wrists, elevated

exposure for upper and forearm and shoulder, light bending of the spinal area. For the removing and mounting of the shaft, the operator had to hold the 19,5 kg (43 lbs.) shaft in one hand while the other hand was used to support the lifting and to actuate the shaft coupling in an overhead position which made the ergonomic risk even worse. To assess the risk, we used a tool provided by the German insurance for occupational health and safety. For the calculation we assumed a) holding > 5s for 5 minutes per day, b) load of 10-20 kg for men, c) holding and mounting an object above shoulder, d) enough space for movement and no obstacles. As result, we came to the risk range 2, which is an elevated but not high risk. For that it is recommended to improve the process, especially for operators older than 40 years or for "newcomers".

This risk could be totally eliminated now, by using the new tool.

As a side effect of the project, emissions of organic vapors and the exposures to the operators could be lowered, because the basin can be covered pretty tight and manual brushing down of remaining paint now takes only a few seconds. And finally working time could be reduced by 208 hours (assumed 2500 cleaning processes/year/ per 5 minutes each).
a. Project Cost= 1,500 $
b. Injury Savings= 15,000$/year (estimated by comparison with OSHA safety pays program (considered tendonitis at the hand possible, 0.25 injury cases per year)
c. Production Savings= 8,400 $/year (assumed 2500 cleaning processes/5 minutes each)
d. ROI= 23,400 $/1,500 $ x 100 = 1,560 %

Payback = 23,400 $/ 12 months = 1,950 $ /month in savings

It takes 3 weeks to payback (in savings) the project.

Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)
Booth # 507
Facilities Maintenance Mechanics "Lifting the Lid"
Raytheon Missile Systems
Tucson, AZ

Presentation Description: It was extremely difficult for operators to lift the heavy metal lid of the dust collector refuse bin (team lift). Mechanic Petersen added a simple but ingenious set of cable assemblies, eye bolts, pulleys and a winch to the dust collector lid so that the lid can be quickly lifted by one employee easily turning a crank. This is a simple and easy-to-use feature that allows one operator to lift and secure the lid (crank it up) using only about 10 pounds of effort.

Problem: It was extremely difficult for operators to lift the heavy metal lid of the dust collector refuse bin. The force required to lift the lid on the collection hopper was measured at 50 pounds. The body was in an awkward position during the lift exceeded normal ergo lift limits and was rated a RED concern by EHSS. It was a 50 pound one-arm lift and hold with an awkward shoulder position and long reach. Mechanic Scott Petersen approached management with a unique and low-cost solution to the problem. After reviewing the proposed solution, Mechanic Petersen was given approval to proceed. Before ergonomics assessment score = RED (more than double Raytheon design specs for single arm force).

Solution: Mechanic Petersen added a simple but ingenious set of cable assemblies, eye bolts, pulleys and a winch to the dust collector lid so that the lid can be quickly lifted by one employee easily turning a crank. The cost to implement was minimal, using a combination of different off-the-shelf parts including a locking ratchet crank arm (less than $500). This is a simple and easy-to-use feature that allows operators to lift and secure the lid (crank it up) using only about 10 pounds of effort.

One injury per year avoided x $40,200 = $40,200

Labor savings per year = $14,400/year

ROI = about one week

After ergonomics assessment score = GREEN (10 pounds of force in good neutral posture)

Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)
Booth # 509
SAT (Shim Adjustment Tool)
Logan Sales Center - Swire Coca- Cola
Logan, UT

Presentation Description: Winner of the 2018 Coca-Cola North American Ergo Cup Competition. This tool was designed to allow for more efficient and safe adjustments to vending machines in order to stock different package sizes. Compared to the prior method involving extended reach, awkward posture, and injuries, the new tool has reduced the risk score from 20 to 1.6, allowed for safer adjustments, & resulted in an estimated annual cost savings of $716k/year.

Problem: Full Service drivers or technicians often have to adjust vending machines for the packages that they dispense. Each package has a different shim adjustment inside the vending machine. When setting vending shims, it is often difficult to fit your arm in the column as needed.

As a result, the technician can receive cuts and scratches from the walls and shims and from the cams below, as well as pinched fingers. This is if a person can even fit their arm in to adjust the shim at all. (as shown in the attached picture this technician cannot reach all the way to the back of the vendor to access the shim). This process of moving the shims by hand wastes time and creates potential safety risks.

Solution: We have developed the SAT (shim adjustment tool) that aides in the adjustment of shims, being able to move them backwards or forward safely and with ease (see video on page 2). Saving injury and time for the technicians. The shim adjustment tool makes it possible for ALL to adjust vending shims.

This tool can also save up to 20 minutes in shim adjustment time, depending on amount of adjustment needed (flavor change/new unit setup). That is an hour a day for each associate! The shim adjustment tool contains markings that allow for quicker adjustment rather than having to count the holes one by one that are difficult to see let alone count.

Measurable Outcomes: Before Brief/Best: 20.0 Medium
After Brief/Best: 1.6 Low

Using the tool across our network of drivers we would expect a cost savings of over $716k per year!

Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)
Booth # 511
The New Philly Flipper
The Timken Company – New Philadelphia Precision Bearing Plant
New Philadelphia, OH

Presentation Description: Timken's New Philadelphia, Ohio Precision Bearing Plant is the only company facility dedicated to producing precision and aerospace Timken tapered roller bearings for international manufacturers of aircraft and precision equipment. A physically demanding to manufacture but low-volume part number unexpectedly became a high-volume customer demand. Associates could only run a few at a time before they complained of sore arms and backs due to awkward postures, high forces and repetition. Risk assessment showed high risk to the upper extremities, and low back. The task was too physically demanding to meet the new customer forecast. The New Philadelphia team stopped production for two months until a safe solution that could meet demand was developed. Three improvements were made in-house to make this a low-risk task and easy to assemble.

Problem: In the past, we assembled 60 pieces a year (5 per month) of a particular part number that was very physically demanding to produce. The customer demand increased this year to 100 pieces per month. To assemble this product, the bearing cup, cone, rollers and cage are placed in a die. The bearing assembly weighs 36 lb. and the die weighed 75 lb. The 111 lb. die/bearing combo is pushed into a press. After pressing the assembly, the die/bearing combo is pulled to the edge of the machine and then the bearing is removed from the die with the fingertips grasping the inner diameter. The bearing is manually flipped 180 degrees, carried to a cage shake gauge and tested. This process is often done several times before the assembly is correctly closed-in. Associates could only run a few at a time before experiencing fatigue and pain in the arms, wrists and back. There was also high potential of dropping

the bearing when lifting the heavy part with the fingertips at the edge of the machine. Due to safety concerns, the plant manager and EHS manager stopped production for 2 months until they could come up with a solution. A quantitative ergonomic assessment indicated high risk to the upper extremities and back and medium risk to the hands and wrists.

Solution: A team consisting of Engineering, Operations, and Safety collaborated to develop three improvements that reduced the task to low risk. The die weight was cut down from 75 lb. to 36 lb. making the push/pull forces on the smooth surface much lower. Second, an elevator system was attached to the front edge of the press where a hydraulic plate lifts the bearing up out of the close-in die. Third, a custom under-the-hook lifting device was designed to slide over the bearing, lift, rotate the bearing 180 degrees, and transfer the bearing to the gauge station. This eliminated all manual material handling, eliminated the potential of dropping the bearing, and made the physical requirements of the process within the operator's capability allowing us to achieve customer demands safely.

Measurable Outcomes: Innovation: After reviewing many possible vendor solutions and not finding a suitable option, the New Philly Flipper was an invention developed completely in-house to address the issue of manually removing, carrying, and flipping large bearings. This particular concept is not used in any of our other similar plants and completely changed the way these are handled.

Simplicity: The New Philly Flipper achieves the desired outcome of flipping and transferring the bearing with a simple mechanical device with very little training or maintenance required. The elevator system is also a simple hydraulic lift that pushes the bearing up through the die to be picked up by the flipper.

Cost Savings: The New Philly Flipper was made in-house for around $350 with many parts salvaged at no cost. If we could not have developed a safe way to assemble these bearings and meet customer demand, we could have potentially lost $400,000 per year. Injury cost avoidance of at least one MSD annually is approximately $7,000. Projected ROI: 115283%. Conservative ROI: 74934%. Payback: 1 Day.

Ergonomic Risk Reduction: The New Philly Flipper completely eliminates all the manual handling of the bearing from machine to gauge. The Risk Priority Score for this task was reduced by 74% from 35.0 to 9.0 following the installation of the bearing flipper. A previously physically demanding job that couldn't keep up with demand is now easily performed and can meet the customer forecast.

Other Improvements: Operator morale has been improved and production consistency can be maintained. This also eliminates the potential for dropping the part impacting quality and acute injury.

Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)
Booth # 600
Flow Rack Flow Control
Toyota Motor Manufacturing Indiana
Princeton, IN

Presentation Description: The Toyota Indiana West Assembly Plant builds the Highlanders and Sequoias. Team members were having an issue pushing back on full totes to clear the stopper on the front of the flow rack while trying to pull the empty tote out of the parts storage/flow rack (stack of totes >32kg), this resulted in multiple WMSDs and an Acute/ Lost Time injury (fracture). This process contributed to several ergonomic and productivity concerns. Production team members designed and fabricated internally a solution eliminating the ergonomic burden of the push force required to remove tote, while improving safety, quality and productivity.

Problem: A typical flow rack is a gravity fed storage rack with rollers on it that allow parts and totes to roll down the rack. Team members pull parts from the tote that is located in the front of the rack. To pull a tote from the flow rack, they have to push the row of totes backwards due to downward force of the row of totes, to free the empty one that they are removing. While investigating the issue, we took push force measurements in which some were as high as 32kgf. These forces were more than three times our plant recommended standard for two hand push (10kgf). Not only did this issue result in an ergonomic concern, it also impacted quality and cost due to dropped and damaged parts from totes falling off of the rack. They were also spending unnecessary time in process to exchange totes affecting productivity.

Solution: Team members designed and created a jig to hold back the row of totes that are coming down the flow rack preventing them from pushing against the tote being used. Once the first tote is removed, the jig cycles, dropping the stopper to allow the second tote to move forward and stopping the next one. This allows the Team member to easily pull the empty tote out of the flow rack without using excessive force to push the row of totes back. This solution also eliminated the danger of the next tote in the row from smashing the Team members hands.

Measurable Outcomes: This solution is a simple innovation with minimal cost to fabricate and no power needed. Team members no longer have to fight totes to remove empty ones, which resulted in no additional new injuries or WMSD cases and no more scrap parts. The ergo assessment score for this application went from a medium risk for shoulder and back to low risk for both body parts. The return on investment is a 24-day return. This also reduced the total weight that team member would have to push annually by over 2278 tons. The solution was also implemented on several other racks in our plant. The jig was shared with other Toyota plants and they have implemented them as well.

Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)
Booth # 601
The Janny Tool
Bridgestone Warren County
Morrison, TN

Presentation Description: In the mold shop teammates have to change out removable identification plates in the molds. The identification plates are wedged into the molds and held in by two screws. The teammates on average change five identification plates per shift. The plates are wedged into the molds making the removal process very strenuous. This project identified hazards associated with the previous removal process and implemented the Janny Tool in its place.

Problem: The problem with removing the identification plates from the molds is that the plates are wedged into place. The tolerance between the mold and the ID plates have to be extremely tight to eliminate flash on the tires. The previous method was to use a slide puller hammer to remove the plates. As previously mentioned, each plate has two screws. The teammate would remove the two screws and screw in a slide hammer. The teammate would have to use excessive force to jar loose the ID plates. This method created risk from pinching fingers to damaging shoulders.

Solution: The Janny tool was created to reduce the risk when changing out ID plates. The Janny tool is essentially a tool created in house that consists of a 27-inch piece of pipe, nylon rocker, swiveling threaded insert. The teammates now insert the threaded portion of the Janny Tool into the screw holes, use the nylon rocker as the pivot point and the 27-inch pipe for leverage to pop the ID plate out.

Measurable Outcomes: - Cost was equal to the slide puller at $100.
- Decreased change out time by 60%
- Weight decreased from 7.3 lbs. to 3.3 lbs.

The greatest measurable outcome was eliminating the pinch point associated with this task.

Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)
Booth # 602
Karakuri Frame Trolley
Toyota Motor Manufacturing Canada
Woodstock, Ontario, Canada

Presentation Description: Team driven activity to countermeasure the need for workers to carry heavy parts across process area. Solution utilizes Karakuri (No energy) to transfer heavy parts in process. Workers no longer required to transfer heavy parts. Elimination of ergonomic burden. Innovative concept design that transfers designated rail through light curtain protected robot cell.

Problem: Workers reporting pain and discomfort when transferring steel window frame part from pallet to welding jig. Unbalanced distribution of part weight resulted in shoulder pain in the worker's when they were carrying the part. Ergonomic assessment was unable to capture the unbalanced part weight.

Solution: We designed a part transfer system that utilizes Karakuri (no energy) and transfers the heavy part into the cell next to the welding jig. This transfer system runs on a dedicated rail that runs through the safety guarding light curtains and into the robot cell.

Measurable Outcomes:

- Ergonomic burden analysis risk reduction from medium risk to low risk
- NIOSH reduced from 2.13 to 0.95
- Reach reduced from 745mm to 435mm
- Total annual savings $30,097
- Return on Investment 1104%
- Payback period 20.35 production days
- Non-neutral wrist posture eliminated
- Frame trolley reduces the unnecessary walk time and saves 3.5 seconds per cycle. Time savings equals 40 additional doors built every day.

Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)
Booth # 603
Automatic Fabric Puller
Cintas Corporation
La Ceiba, Honduras

Presentation Description: We are the fabric cutting part of Cintas and our role is to cut fabric for garments and uniforms. As a cutting center, we have to spread fabric across long tables and manually pull the plies of fabric towards the cutter. We changed the process by installing an electrical winch type motor to pull the fabric just by pressing a switch. Now the motor pulls the fabric instead of the operator.

Problem: Employees lay out 150 individual sheets of fabric for the cutter requiring an extensive amount of walking. Once the laser cuts the 150 blanks partners had to pull the fabric 108 ft. down the table with a sustained pull force of 45lbs. This process required reaching out of their power zone causing them to put their bodies in prolonged awkward postures. Affected body parts were shoulders, arms, back and neck.

Solution: We purchased an electrical winch type motor to pull the fabric (we designed the base so that way the motor will pull the fabric instead of the partner) and the results of this were 4,777 movements eliminated annually.

Measurable Outcomes:

- The motor works by pressing a switch, which means we eliminated the carrying distance of 66,878 meters annually and 71,655 pounds of carrying force annually used to transport spread fabric from the tables to the cutter machine.
- The spread fabric is pulled with a motor towards the cutter. With this we eliminated the pull force of 214,965 pounds annually (45 pounds average per spread fabric)
  3% Efficiency improvement by marker

Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)
Booth # 604
Push-It-Pin (PIP)
Toyota Motor Manufacturing Kentucky
Georgetown, KY

Presentation Description: In 2016, manual interior spray application was replaced by robotics in Spray Booth A. This change required the elimination of door springs and the introduction of checker arms on 9/19/2016. The purpose of these door springs & checker arms is to keep the doors closed as our vehicles travel throughout the Paint shop, thereby, preventing any damage to the vehicles & the equipment. The new checker arms significantly increased the resistance when opening/closing doors causing an ergonomics concern in Paint shop. TMs were required to repetitively hand start bolts to attach.

Problem: TMs were hand starting bolt into A-Pillar. 7-9 turns to start bolt. After 2 cycles the bolt could not be hand started, shop gave TMs an impact gun, 4 lbs. and L-shaped caused wrist strains and mutilations

when removing bolt. Eliminated 4 sec of work per/car. Bolts were made into jig, TM had to work OT to replace bad bolts, bolts cost $5 each.

Solution: Developed Push Pin which eliminated bolt that impacted 4 processes within Paint.

Measurable Outcomes:
SAFETY BEFORE: 8 ESI (early symptom intervention) reports, 1 recordable injury, & 1 first aid-level injury within 4 months
SAFETY AFTER: 0 injuries or TM concerns over 6 months after implementation

PRODUCTIVITY
4 seconds/vehicle time savings due to hand start reduction

COST
$5/bolt to replace old system + overtime worked by TM to replace when threads worn

Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)
Booth # 605
Hospital Scrubs Ergo-Buggy
Cintas, Location - 258
Lawrenceville, GA

Presentation Description: One of the services Cintas provides customers is to pick-up and deliver hospital scrubs. Two of our accounts require us to supply approximately 1,500 scrubs daily for each hospital. These scrubs are bagged 40 items (shirts or pants) per sizes (S, M, L, XL, 2XL) in a plastic bag that weighs 25 lbs. Each day, we have to pick-up 70 of these 25 lb. bags. To solve our lifting problem, we created a cart with a 10-compartment divider, that helps us organize and transport the scrubs. Each compartment has a spring-loaded bottom that lowers as we load the individual compartments, reducing the amount we have to bend forward. This idea has made our process faster and more accurate, since we now have a better sorting system. It has also greatly reduced the stress on our backs from the constant leaning forward we had to do.

Problem: The issue with the Hospital Scrubs was bagging 40 items (shirts or pants) per sizes (S, M, L, XL, 2XL) in a poly bag that weighed 25 lbs. for a total of 70 bags daily causing poor posture handling, lifting and pulling and pushing of heavy weight, frequency and repetition of tasks, fatigue and discomfort of the body and inefficiency in the production operation.

Solution: A large cart was created with Leebaw Mfg. Company and a 10-compartment divider was built in-house. Three different carts were designed and used on each of three shifts. This helped us completely eliminate the poor posture problems, the pulling and handling of heavy plastic bags, the frequency and repetition of manually hard tasks, and it reduced the discomfort and fatigue on the body. It also improved the efficiency and the effectiveness of the production operation.

Measurable Outcomes: At Cintas, we use an internal risk assessment tool called Motions Saved. Using this assessment, we eliminated about 42,000 back motions and 2,100 shoulder motions per week. We eliminated 8,750 lbs. of push pull force per week and provided a much shorter push/pull distance and a much better handle height for each partner. Not only that but we also eliminated the lifting and carrying of 350 bags per week from the floor to the pallet crate bin and vice versa, eliminating both the lifting and carrying distance completely and saving another 2,100 shoulder motions per week. We eliminated completely the bagging of approximately 350 bags per week to just filling up about 30 carts of scrub items per week. We achieved 20% improvement in weekly productivity and efficiency by adding 3,000 more scrub items processed with the Ergo-buggy versus the bag system. We achieved 100% better quality appearance for the hospital standards and more professional looking delivery not to mention how much easier the material handling process is. In addition, we saved $3,336.84 annually for 73 rolls of plastic bags not needed anymore. The solution also helped with the hygienic process of the scrubs by preventing from touching the floors or any surface that does not meet the hygienic standard of the hospitals.

Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)
Booth # 606

The Pup (IP Line Kit)
Toyota Motor Manufacturing Kentucky
Georgetown, KY

Presentation Description: Assembly TM is required to manually push dolly while loading kit boxes. TM loads 4 totes at a time and travels ~80 feet per cycle, pushing the dolly the entire way. TMs reverse engineered a scanner, which tracks the TM and powered the dolly so that the dolly "follows" the TM, like a pup, while they load it. This eliminates the pushing of the dolly.

Problem:
1. T/M's are experiencing an ergonomic issue when moving Kit Box Dolly through the Kit Area.
2. T/M Pushes Kit Box Dolly while SEQ parts through process 80 FT. in length one way.
3. Standard Push Force is 4-10 KG.
4. When Fully Loaded - Push Force is 18 KG.
5. TM were miss seq. parts on occasion because they were rushing to get dolly back to the home position.

Solution:
1. T/M no longer has to push seq. dolly back to the home position.
2. Reversed Engineered Fan Pattern now allows the Dolly to follow T/M's when they are within the yellow zone area. And the safety red zone area will still protect the T/M's within its normal range.
3. 24 Volt DC AGV returns the dolly to the home position
4. Eliminates TMs need to return dolly

Measurable Outcomes:
1. Eliminates push/pull of dolly (10+ KG push force)
2. No injuries or concerns from TMs since implementation
3. 22 min/day time savings

Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)
Booth # 607
Flywheel Coupling Lift Adapter
Cummins Technical Center
Columbus, IN

Presentation Description: A trades associate noticed a potential health and safety concern regarding lifting and handling couplings. He spoke with another trades associate who specializes in fabrication regarding potential solutions for the problem. The two associates consulted with two site HSE professionals to design, fabricate, test, and certify a below the hook lifting device. All design and fabrication were done in house. The only outside representative was the Professional Engineer that signed off on the design as a certified below the hook lifting device.

Problem: Technicians are required to handle the coupling during its installation in build and preparation areas, during engine install/uninstall, and part failures. There are two different couplings used depending on engine size. Medium duty (MD) couplings weigh 52 points and heavy duty (HD) couplings weigh 106 pounds.

Attaching the coupling to the flywheel required the technician to bend over or kneel in order to pick up and lift the coupling into place. The technicians would then hand thread a few bolts to hold the coupling in place and finish installing the remaining bolts with an electric or pneumatic wrench.

The initial evaluation for the HD coupling determined that there was an unacceptable level of risk for the arms and backs of the technicians. The NIOSH lifting equation resulted in a score of 10 which indicated the task could not be performed safely and engineering controls should be implemented.

The initial evaluation for the MD coupling determined that there was an elevated level of risk for the arms and backs of the technicians. The NIOSH lifting equation resulted in a score of 2.1 which indicated that the task should be modified with engineering or administrative controls to reduce the risk.

Solution: A lifting adapter was designed to reduce the need for a technician to manually handle the coupling. This adapter was designed as a below the hook lifting device in order to utilize the hoist found in the areas where coupling handling primarily takes place. The design was devised by two trades associates that work at the Cummins Technical Center. The adapter was further reviewed by two site HSE professionals that provided input and facilitated the below the hook lifting device certification that was reviewed and approved by an outside professional engineer. The adapter has additional features that allow it to rotate freely 360 degrees around the swivel D-hook, rotate +/-30 degrees around the hub to facilitate bolt alignment, and multiple threading sizes to allow the mounting plate to accommodate both sizes of couplings.

Measurable Outcomes: Since implementation of the device we have received positive feedback from technicians throughout the facility. We have had additional groups that we originally had not identified as potential users' express interest and place orders without fabrication shop for their own coupling lifter adapters.

We have also calculated a return on investment of 1744%. This was done by estimating a lower back injury from lifting which was taken by OSHA's Safety Pays program ($69594) and our cost of implementation ($2500). Additional lifting devices are expected to cost less than $500 per device.

The NIOSH lift/lower equation reduced the HD coupling value from 10 to .2 and the MD coupling value from 2.1 to .2.

Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)
Booth # 608
3D Printed Self Lubrication Rail system
Toyota Motor Manufacturing, TX, Inc.
San Antonio, TX

Presentation Description: Toyota Motor Manufacturing, TX, Inc. (TMMTX) is in San Antonio, Texas and is home to both the Tundra and Tacoma pickup trucks and build over 166,700 trucks in 2017. The Paint shop has 7.9 miles long P&F conveyors that holds the carriers and trucks that enter and exit the paint shop. The inside surface of the rail, which contacts the trolley rollers, needs frequent lubrication with grease to prevent excessive wear and breakdown of the rail system. The rail system is located overhead and most often very difficult to access.

Problem: Team Members must manually lubricate over 240 overhead surface points on P&F rails that hold the carriers. A power and free (P&F) conveyor consists of a continuously-moving powered chain, which when engaged, moves a free (non-powered) load-carrying trolley through the conveyor system Team Members need to climb a ladder ranging from 14 feet to 40 feet above to lubricate each section of P&F rail with a brush. While standing on a ladder and brushing, Team Members are placed in an abnormal ergonomic position of head, neck, shoulders, elbows, and wrist to assure all parts and angles of trolley is properly lubrication on the rail system.

Solution: Team Members designed, and 3D printed an auto lubrication cartridge. The 3-D printed brackets on the cartridge holds grease tubes and brushes. The auto lubrication cartridge is mounted on a trolley on the P&F and simply rides on the rails throughout the system. The lubrication system is set to complete every month. Team Members can install and replace cartridge at platform level, eliminating all ergonomic reaches and risk associated with old method.

Measurable Outcomes:

- Prevents 480 hrs. of manpower greasing rails in annual production savings of $25,095
- Cost avoidance of 1 injury/year results in an annual savings of $33,000 (direct + indirect cost)
- Cost of solution was $25 (cost of materials + labor)
- ROI = 5237,080%, with a payback period of less than 1 day
- 100% elimination of all Ergonomic reaches and risk

Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)
Booth # 609
RotoErgo - Improving Ergonomics in Roof Sub Assembly

Cummins Power Generation
Fridley, MN

Presentation Description: The RotoErgo solution was designed to sub assemble the roof in the best ergonomic way possible before installing it on the generator. There are three different types of generator models that have three distinct roofs installed on them. The challenge was to design an innovative solution that could cater to all different types of roofs used on the assembly line. The entire concept of RotoErgo was designed and fabricated in-house by Manufacturing Technicians. This solution shows how we can use our in-house talent to come up with innovative solutions that fix ergonomic issues.

Problem:

- Manual handling of the roof weighing ~150 lbs.
    1. Lifting
    2. Flipping
- Manual operation detail
    1. Roof is presented on the line in wooden crates. Initially operator must lift the roof manually out of the crates and put it on to the sub assembly table.
    2. Put the insulation on one side
    3. Again, manually lift and flip the roof 180 degrees to do the assembly work on other side of the roof

Number of operators required to lift and flip the roof varies from 2 to 4 depending upon the size and weight of the roof. Heaviest and largest roof they must lift/flip has dimensions of 10' x 5' and weighs ~150 lbs. Lifting and flipping ~150 lbs. roof manually puts a lot of strain on operator's back, arms, and shoulders. Both lifting and flipping of the roof represents ergonomic risk to the employee. Score from humantech assessments for lifting and flipping roofs are 31 and 45 respectively. Considering the humantech guidelines these processes can be classified as having high ergonomic risk associated with them (As per the humantech guidelines, any process having score of more than 30 represents high ergonomic risk associated with it).

Solution: To eliminate manual lifting

- Design a custom lifting device

To eliminate manual flipping

- Design a custom rotary fixture
    1. To have accessibility from all sides
    2. To enable most of the work in power zone
- Advantages of custom rotary fixture
    1. Roof can be rotated 360 degrees with minimal force
    2. Feature to lock the fixture at increments of 45 degrees
    3. Fixture can be adjusted to accommodate different lengths and width of the roof

These two solutions eliminate the manual handling of the roofs. Employee can use the hoist to lift the roofs out of the crates and place it on the rotary fixture. Once the roof is installed in the rotary fixture, it can be rotated 360 degrees to work on all sides of the roof. Rotary fixture consists of two stands. Each stand has a bar with clamps at the end to hold the roof and roof can be rotated with minimal force using bearing mechanism in the fixture. Use of lifting device and custom rotary fixture also reduces the number of operators required to do this process from 4 to 1.

As no rotary fixture available off the shelf was suitable for our application, we had to come up with an innovative design of custom rotary fixture that will be suitable for different models of roofs and fabricate it in-house.

Measurable Outcomes:

Productivity savings $7,500
Avoidance savings $69,594
Cost to implement - $1,500

Total savings $75,594
ROI 5,039%

• Productivity savings
  o Time saved by reducing the number of manpower required to do the task
  o Number of manpower reduced from 4 to 1
  o 5 min (Time saved per operator in lifting and flipping) X 5 units/day X 240 manufacturing days/year = 6000 min/60 = 100 hours *$25/hour = $2,500 per operator * 3 (Number of manpower reduced) = $7,500
• Avoidance savings
  o Potential OSHA recordable
? $69,594 cost for strain
• Cost to implement
  o Number of hours of a full-time employee
  o 60 hours (Number of hours of FTE required to build the fixture) * $25/hour = $1,500

Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)
Booth # 610
SaraSara
Toyota Motor Manufacturing, TX, Inc.
San Antonio, TX

Presentation Description: Eliminating unnecessary movements and ergonomic burden in production or a process is one of the main principles of Toyota. These extra movements including wasted walking in process can lead to serious cumulative injuries and illnesses. Assembly Conveyance Team Member must drive a tugger and dolly system to deliver Tacoma and Tundra prop shafts line side for production. They must get off tugger, walk to each mod and physically push the mods to move prop shafts line side causing a lot of stress to hands, wrist, and elbows. Team members were able to design and create a "no touch" delivery system that uses gravity, levers, cams and inertia to move and transfer parts between delivery mods and production. This has eliminated 100% of material handling and 100% of walking as Assembly Conveyance Team Members drives to a certain point to cause the lever to engage and the exchange occurs.

Problem: Once the Assembly Conveyance Team Member reaches the area where they must drop off their delivery, they must get off tugger and physically push the mods to move prop shafts line side. To help with transition of prop shaft from tugger to line side the Team Members use a "bridge" like system to push the mods onto rollers. The Team member must then pick up the empty modes/jigs by hand and place on the tugger to transport back to loading dock for reuse. Now that the Prop Shafts are positioned line side the Production Team Member uses a hoist to move the prop shaft into position on the frame of the truck. Every 3rd truck the Production Team Member must pick up and carry the empty mod/jigs to a return area to allow then next full mod/jig for production. Weight per 6 trucks 45 lbs.

Solution: Production team members and the fabrication team closely studied how to reduce the lifting and awkward ergonomic postures that can lead to cumulative injuries. The new delivery system (Sara Sara) uses weights and counterweights in order to deliver the prop shaft from the delivery mods to production line side. SaraSara delivery can self-send and self-return empty mods using the weights, counterweights, and gravity. The implementation of the SaraSara has eliminated over 1 million lbs. of weight carried per year and eliminated over 2 million walking steps.

Measurable Outcomes:
- Reduced cycle time 115 secs with annual production savings of $55,678
- Over 1 Million of lbs. carried and 2 million steps per year
- Cost avoidance of 1 injury/year results in an annual savings of $33,000 (direct + indirect cost)
- Cost of solution was $36,000 (cost of materials + labor)
- ROI = 146%, with a payback period of 99 days
- Total Annual Savings of $88,678

Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)
Booth # 611
Credenza Monitor Lift

Gulfstream Aerospace Corp.
Appleton, WI

Presentation Description: During the performance of installing, adjusting and testing of the credenza monitor lift, Cabinetmakers are required to work in awkward positions of kneeling, laying on floor, twisting and reaching while performing multiple tasks in a very confined space inside the aircraft. This puts the worker in awkward postures and creates undue neck, shoulder and back stress as determined by an ergonomics risk assessment. This new holding fixture, designed by employees on the shop floor, reduces the ergonomic impact of muscle fatigue by moving the operation from inside the space constrained confines of the aircraft to an adjustable work station in the back shop.

Problem: Credenza monitor lift is installed, adjusted, and tested after the credenza is installed into the aircraft. Limited accessibility inside the aircraft causes mechanics to work in awkward positions of lying on the floor, kneeling, bending, twisting and reaching inside cabinet to make final adjustments to the power lift mechanism causing neck, back and upper body fatigue.

Solution: Fabricated an aluminum block used as a substitute for the real credenza monitor. Along with placing the credenza on a lift table, the new process allows the mechanic to make the needed adjustments, check the plug fit and check for binding or noise in a more ergonomically friendly position while in the back-shop verses inside the aircraft.

Measurable Outcomes:

- An ergonomics risk analysis, using Auburn Engineers e-Tools programming, was performed indicating moderate to high risk to the back, neck and upper arm/shoulders. The program calculated a Risk Factor Score of 22 points. A follow up risk assessment was done using the new process resulting in a calculated Risk Factor Score of 2 points; for a total Risk Factor reduction of 22 points.
- Eliminated excessive demands of lying on floor, kneeling, bending, twisting and reaching while performing tasks inside the aircraft.
- Dramatically reduced the excessive demands of working in a restrictive and confined space inside of the aircraft.
- 72% reduction in labor hours. Reduced hours from 140 per aircraft to 40 hours
- Install average of 20 credenza's (with power lift assist) in aircraft per year
- Annual cost savings of $156,000
- Initial investment of $30 for aluminum block
- 400% Return on Investment
- A safer, more ergonomic work place
- Cost avoidance for back or neck injury (according to Department of Labor statistics) is estimated to be up to $100K/event for workers compensation claims and medical costs

Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)
Booth # 700
The Pit Crew
Honda of America Mfg.
East Liberty, OH

Presentation Description: One of the jobs that Repair associates at ELP may have to do is to change out and/or remove the tires from a vehicle. This requires associates to manually lift heavy tires from a low level to around shoulder height. On average, associates remove 27 tires per day for change out and/or other repairs. The team developed a tire tool to eliminate bending and high reaches during the lifting of tires weighing up to 67 lbs.

Problem: The Repair associates who must change out tires have to manually lift tires weighing up to 67 lbs. The associate bends 35° to pick up the tires and lift them up to about shoulder level to install them on the vehicles. The NIOSH Lifting Analysis indicated a lifting index of 4.6 for the heaviest tire, way in excess of the limit of < 1.5 specified in the Honda Ergonomics Guidelines.

Solution: Working on an idea of using a decommissioned piece of equipment, the team set out to develop a tire tool to lift and position the tire. The team tried different mechanisms to adjust the height of

the tire. The team also added a ramp to allow the associate to roll the tire on to the tool to eliminate all manual lifting throughout the process.

Using already available scrap materials and a decommissioned piece of equipment, the payback for this tire tool is immediate as it eliminates the cost of $7,500 if the tool was outsourced. The cart also eliminates all manual lifting, decreases the risk of potential injuries related to removing tires from the vehicle ($12,920 per year at ELP) and dropped tires which can affect quality (Cost Honda on average $230 to replace a damaged tire and rim). All other Honda facilities, automotive manufactures, tire repair shops, car dealerships, and any other facility dealing with removing tires can use a tool like this to reduce/eliminate the risks involved.

Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)
Booth # 702
"Stuck On You" - Magnetic Part Separation
Honda of Canada Mfg.
Alliston, Ontario, Canada

Presentation Description: A Team of Honda of Canada Mfg. (HCM) associates designed and installed a magnetic metal parts separation tool used to separate metal parts that are tightly nested together during the delivered process. Previously, associates struggled to pry the parts apart with their gloved hands, requiring a pinch grip force of 10.2 lbs. Upon introduction of the magnetic field, the metal parts are forced apart minimizing the pinch grip force to 2.0 lbs.

Process efficiency increased by 15 units per day, morale improved along with elimination of struggle with separating nested parts.

Injury avoidance = 2/year. ROI=135, payback in 28 hours.

Problem: Door stiffeners parts thickness is 0.4mm and come line side in a large bin holding 600 stiffeners all nested tightly together. These nested bulk parts require a maximum pinch force of 10.2 lbs. to separate the metal parts. Associates handling these parts are required to wear Kevlar gloves increasing the difficulty associated with separating the parts. Associates continued exposure to the process leads to strain on associate's fingers, hands and shoulders. Part damage occurs occasionally depending on the degree of union between parts.

Solution: A metal brush was introduced to catch the part edge to help minimize hand strain, although associates found it cumbersome and time consuming to use.

The next attempt at addressing this concern involved designing a fixture that holds parts and positions magnets to separate them. For this method to work, rare earth magnets were added to a parts fixture that was designed, fabricated, installed and tested in house. This simple design required no electrical or pneumatic power to separate the parts.

Part size and lubrication makes placement of the magnet's fields crucial. The fields need to be concentrated to ensure the separation of the nested parts without causing parts damage.

The second prototype design incorporated a part stacking area on the rack itself to reduce the need to obtain parts from the cart.

This improvement was implemented for CRV door and hood processes eliminating 2-point pinch grip ergonomic concern and have been well received from production associates.

By applying the parts separator, the process no longer requires excessive force to pry the parts apart. A spin off benefit has been an increase in process efficiency and an increase in daily output.

In house pinch force test results:

- Before: 9.5; 9; 8.7; 9.2; 8.5; 10.2 (lbs.*force)

- After: 4; 3.6; 1.7; 2.4; 1.5; 2 (lbs.*force)

Safety: No ergonomic or non-ergonomic injuries sustained to date since implementation. The repetitive pinch grip force was reduced 80% from 10.2 to 2.0 lbs. average.

Quality: Deform free parts; parts not excessively stacked upon each other, no contact.

Delivery: Increased process efficiency by 12 minutes per shift (3% improvement); More time available to inspect parts due to elimination of struggle to separate them.

- TIME Savings 1.6693 sec
- Cell Cycle Time Before 50 sec
- Cell Cycle Time After 48.3307 sec
- Production Time (Seconds) 27180
- Cell Efficiency 80%
- Production Units per shift Before 434.88
- Production Units per shift After 449.9004
- Potential units increased per shift 15.02037

Cost: ROI = (Output – Input)/Input

ITEM COST
- Initial cost for Magnets ($150 each for 6 magnets) $900
- Stiffener dispenser (no adjustment cost – same dispenser as previous) $0
- Parts for Hood Cart Mobile Adjustable Magnet (made using in house parts) $0
- Cost for Maintenance / Engineering / Fabrication (made in house) $0
- Cost for damaged dropped parts (sent back for recycling) $0
- Potential production gain of units @15 per shift ($833.33 per min X 12.52 min (50 sec per cycle) rate determined at 870 units per day; Obtained additional 12 minutes per shift to inspect parts and reduce outflow. 10,430.77
- Injury cost avoidance of 2 claims @ $56,000 cdn per claim $112,000
- Input: $900 Output: $112,000 +10,430.77 (Injury cost avoidance + Potential Production gain of units)

ROI = (122,430.8-900)/900 = 135 Payback = 900/ ((122,431+900)/244 (business days)) = 1.8 days OR 28.0 hours

Morale: Positive associate involvement and cooperation (Voice of Floor), eliminated struggle with nested parts.

Workplace Solutions I (Team-Driven Workplace Solutions with internal competitions)
Booth # 704
Weightless High Torque Motor Application for F-35 Vertical Tails Installation
Lockheed Martin Aeronautics Company
Fort Worth, TX

Presentation Description: New tooling was designed, prototyped, built and introduced into the left- and right-hand side vertical tail attachment process of the F-35 aircraft. Incorporation of the new tooling significantly reduced injury risk associated with repetitive extremely high manual forces exerted to torque the high-tension bolts. The introduction of a more controlled process also significantly reduced risk of damage to the aircraft and enhanced the quality and repeatability of the final torque.

Problem: During production of the F-35 aircraft, the left and right vertical tail sections must be attached to the body of the aircraft with four high-tension bolts. To seat the 4 bolts that attach the LH and RH Vertical Tail to the aircraft requires the tapered sleeves and bolts to be seated prior to the final torque. To accomplish this task the mechanics used a 4 ft long ratcheting torque wrench and an 18-inch breaker bar to draw the tapered bolts into the fittings. Each of the bolts took about 80 plus torque stroke repetitions against a 300 - 500 ft. lbs. torque force and about 30 minutes to install. The Operator fatigue was extremely high, and fondness of the task did not win many hearts over from the chosen.

Solution: The Vertical Tail Mechanics requested a torqueing method that was less fatiguing to install the 4 high torque bolts to attach the Vertical Tails. After several iterations of problem solving, prototyping and testing, the Enterprise Drilling Technology and Integration Team (a Lockheed Martin internal team tasked with ensuring drilling/hole-prep excellence across the enterprise) partnered with external tool manufacturer, American Assembly Tool to develop a custom torque motor with a reaction arm that would eliminate any torque forces transferred to the operator. The New Torque Motor with the torque reaction arm preformed successfully but had one major draw-back; the 60 lb. weight of the motor with the off-center reaction arm had the potential of being a handling and safety issue for the mechanics.

The shop floor mechanics worked with supplier, Alumi-A-Lift to develop a custom portable lift with a 5-ft reach tool balancer arm that eliminated manual handling of the torque motor. The torque motor and lift now provide an ergonomic solution by allowing the maneuvering of the torque motor in a weightless environment. Reducing the time required to accomplish the torqueing task from 2 hours to 1.3 minutes also provides a significant efficiency enhancement.

Measurable Outcomes: Implementation of the new torqueing tool yielded:

- Significant efficiency gain, reducing the time to complete the torqueing task by 99% (from 2 hours to 1.3 minutes).
- Significant reduction of injury risk related to prolonged repetitive (approximately 80 strokes per each of four bolts) extremely high-force manual torqueing.
- Eliminated potential damage to aircraft from contact with ratchet extension handle.

Workplace Solutions I (Team-Driven Workplace Solutions)
Booth # 401
Radome A.I.R. (Articulating Internal Repair) Tooling
Delta Air Lines Technical Operation Center
Atlanta, GA

Presentation Description: Delta Air Lines will showcase the process improvement of the internal repair of the aircraft Radome. This was a shop designed and fabricated articulating holding fixture that our team will display at the Ergo Cup Booth. An accompanying video will show the old process and the Team will present a demonstration of the new fixture and process. Display will include how Delta has developed a one-page document for management that is easy to read and communicates what reduction in risk score was achieved when sound Ergonomic principles were implemented.

Problem: The old process presented multiple ergonomics challenges, requiring kneeling or lying on the internal Radome shell to perform repairs. The task involved: bending over 45 degrees, kneeling on the hard surface of the internal shell and lying on the floor while extending the arms for long periods.

Solution: Delta Tech Ops Radome repair Team designed and fabricated the Radome A.I.R tool in-house. The new tool eliminates kneeling and lying positions during the repair, as well as facilitates proper ergonomic posture to minimize potential MSDs. The fixture can be adjusted from 10 to 33.5 inches in height; additionally, the fixture can articulate approximately 77 degrees in the Z axis to facilitate repairs at various angles. The tool can accommodate a variety of Radome fleet types with the adjustability of the equipment being simple and easy to use.

Measurable Outcomes: Testing of the new aircraft Radome A.I.R. tool has shown that the total REBA score decreased from 14 to 4, and the SI score decreased from 4.5 to 0.8, which significantly reduced the potential for MSDs. Technicians reported improved comfort and reduced physical stress while also decreasing turn times by approximately 30-40%.

Workplace Solutions I (Team-Driven Workplace Solutions)
Booth # 403
New Twist to an Old Problem: Deburring 1.540 Rods

ATI, Huntsville, AL

Presentation Description: An employee-led ergonomics team was presented with a challenging problem with a deburring process for metal alloy rods. The facility was experiencing indicators for cumulative trauma disorders due to repetitive wrist motion while rotating large diameter rods. The facility was also experiencing high re-work and equipment maintenance rates due to manufacturing inconsistencies. This employee-led team turned to process and equipment design changes to yield great results.
The use of the new rod deburring support arm and process change resulted in an 83% reduction in ergonomics risk factor score, a 96% decrease in re-work and a 70% decrease in equipment maintenance. The cost for the solution was only $200 and all work was done in-house. A total cost savings of up to $139,347.32 was achieved by using the support arm and the total annual ROI for the project was up to 69,573.66% with a payback period of as little as half a day.

Problem: A deburring process is used to create a beveled end of metal alloy rods using a belt sanding process. The deburring process involves placing the rod by hand at a 45-degree angle against the belt sander. While supporting the rod by hand the operator must rotate the rod to achieve the desired bevel. Holding the rod while deburring requires up to 50 lb. of handgrip force and turning the rod requires up to 50 lb. of pinch grip force. An ergonomics assessment on the task revealed high risks for both hand grip and pinch grip.

Operators have reported hand/forearm pain, shoulder pain, and numbness in the hands. An ergonomics evaluation performed on the task revealed high risks for handgrip and pinch grip. These high risks indicated that medical intervention is imminent within two years for each of the six employees performing this task.

Solution: Workarounds such as work method change and employee rotation were used to mitigate injury from repetitive motion. The ergonomics thought that a simplistic approach to the process and equipment design was needed. The team found that rod support arm removed the weight of the rod, significantly reducing the hand grip force necessary and eliminating the pinch grip force.

The use of the rod support arm also presented an opportunity to control and standardize the beveling on the end of the rods. Controlling the bevel angel and consistency of deburr allows for a more uniform rod resulting in minimal rework along with less frequent equipment maintenance.

Measurable Outcomes: The measurable outcomes from this project are as follows:

- 100 % reduction in pinch grip force (50 lb. to 0 lb.)
- Reduction of a high risk for handgrip to a low risk on the ergonomics evaluation and elimination of high risk for punch grip
- 83% total reduction in total ergonomics risk score (12 to 2)
- Annual injury avoidance cost savings of up to $38,000
- Up to 96% decrease in rework resulting in annual cost savings of up to $5,568
- Up to 70% decrease in equipment maintenance resulting in annual cost savings of up to $95,779.33
- Total annual cost savings of up $139,347.32
- Total annual ROI of up to 69,573.66%
- Payback period of less than half a day

Workplace Solutions I (Team-Driven Workplace Solutions)
Booth # 405
D-Container Improvements
Estée Lauder Logistics AG
Brunegg, Switzerland

Presentation Description: The Estée Lauder Companies' distribution facilities in Lachen and Brunegg, Switzerland distribute cosmetics to its global customer base in Travel Retail Business. At these sites, "D-containers" (or Gaylord containers) are commonly used for air-freight shipments due to security requirements. These containers create significant ergonomic risks both during construction and packing. This project, led by a cross-functional team, changed the design of the D-containers along with modifying an existing tool to remove the ergonomic risk of bending.

Problem: D-containers are large corrugated boxes made of two pieces which are delivered folded to our distribution centers: a base made of 4 walls that need to be nailed to a pallet, and a second part that is added on top of the first one, after the boxes have been loaded.
The nailing of the first part is done with use of a compressed air-nail gun. The employee needs to reach out over the D-container side and bend to nail each of the bottom corners to the pallet. Packing the D-containers is then done manually with employees bending over the D-container to load multiple boxes weighing up to 41 lbs. each. Employees noted the numerous ergonomic risks associated with each of these tasks and began to develop a solution that could improve overall employee safety, productivity and security requirements.

Solution: The solution began with the development of a new D-container design with the supplier that allowed easier employee access during the construction of the container as well as the packing of the container. This initial design still had some accessibility challenges while employees were packing the boxes for shipment. The second design improved employee access while packing, however, the container was not as durable. The final design allowed for the greatest amount of employee access with minimal ergonomic risk along with the durability and security required for shipment of the product. Once the final D-container improvements were identified, the nail gun used to affix the box to the pallet was modified with an extension that eliminated the need for employees to bend down into the D-container during its assembly.

Measurable Outcomes: This employee-led effort helped to eliminate ergonomic risks during the assembly of the D-containers as well as significantly reducing the ergonomic risk during the packing of the containers for shipment, which is done about 100 times per day. The new D-container design and modified nail gun have also led to a 24% productivity improvement.

Workplace Solutions I (Team-Driven Workplace Solutions)
Booth # 407
Bulk Supply Hole Covers
Estée Lauder Companies
Oevel, Belgium

Presentation Description: The Estée Lauder Companies' manufacturing facility in Oevel, Belgium produces cosmetics products for many brands within the Company. Within the Tubes and Liquids department, there are a number of bulk supply hole covers that need to be handled multiple times throughout the day, presenting both ergonomic risks as well as slip/trip/fall risks for other employees working the area.

Problem: Employees in the department handle 25 bulk supply hole covers approximately 200 times per day. The existing hole covers were low to the ground, requiring employees to bend all the way down to the floor. In addition, the existing hole covers were not always seen by other employees working the area, potentially leading to slip/trip/fall injuries, along with possible handling equipment damage.

Solution: The BBS Steering Team worked together with all of the department employees who complete this task daily to develop a simple in-house solution to reduce ergonomic risks along with making the work area safer for all employees. A cover with a raised handle was proposed and designed by the project team. The maintenance department was able to fabricate the new handle in-house at a very low cost. Employees no longer have to bend down to move the hole covers throughout the day. Additionally, the inclusion of caution signage on the new handles has significantly reduced the risk of slip/trip/fall injuries within the work area along with fewer incidents of property damage.

Measurable Outcomes: This low-cost employee-led effort in designing the updated bulk supply hole covers has reduced ergonomic risks for this task by 68%. Additionally, there are fewer risks of slip/trip/fall injuries for employees working in the area. Damage by handling equipment used in the area has also been significantly reduced with the increased visual awareness of bulk supply hole locations.

Workplace Solutions I (Team-Driven Workplace Solutions)
Booth # 409
Lipstick Mass Cutter

Estée Lauder Companies
Oevel, Belgium

Presentation Description: The Estée Lauder Companies' manufacturing facility in Oevel, Belgium produces cosmetics products for many brands within the Company. Lipstick production has been a key part of the site operations and cutting the mass for each batch has been a challenge throughout the years. The lipstick mass cutting is performed manually with a "cheese" knife, resulting in both high ergonomic and cut/laceration injury risks.

Problem: Each day, approximately 100 buckets of lipstick mass need to be cut for production batches. When using the old fashioned "cheese" knife, there were high ergonomic risks for shoulders and wrists along with high risks for cuts and lacerations while cutting the mass as well as when cleaning the "cheese" knife.

Solution: Since this daily task was a high risk, the department employees worked together to develop an in-house solution for a safer cutting tool for lipstick mass. Employees involved with supplying the bulk for the daily batches, technical coaches, the BBS Steering Team, along with the EAS Team worked through a number of different solutions, seeing improved results with each version. The final design was developed after reviewing the possibility of using cheese cutting devices due to similar characteristics of the lipstick mass. A cheese cutting device was purchased for testing followed by developing a prototype more suited to use with the lipstick mass. In addition to the prototype design, the mass cutting task process was reviewed in total to ensure that the new tool provided as much automation as possible. The final design of the new mass cutting device was reviewed by a Certified Ergonomist and the order was placed with an outside vendor to fabricate the new lipstick mass cutter for the site.

Measurable Outcomes: This multi-phase employee-led effort in designing a new lipstick mass cutter has reduced ergonomic risks by 50%. Additionally, the risk of serious cuts and lacerations while using or cleaning the old tool has been significantly reduced. Finally, in addition to making this high-risk task safer overall for the employees, the new lipstick mass cutter also resulted in a 60% productivity improvement for this high-volume daily task.

Workplace Solutions I (Team-Driven Workplace Solutions)
Booth # 411
Power Prime Pump
Estée Lauder Companies
Petersfield, Hampshire, United Kingdom

Presentation Description: The Estée Lauder Companies' Whitman Laboratories facility in the UK produces cosmetics products for many brands within the company. An Elevator Pump, known locally as a Power Prime Pump, is used within the Compounding department to transfer silicone-based raw materials from drums to mixing vessels where the material cannot be inducted. The BBS Steering Team took on the project to make it easier to load drums into the pumps and reduce ergonomic risks for employees in multiple departments at the site.

Problem: The original process of getting drums onto the pump platform required two employees: one to steady the pump while the other employee maneuvers the large drum weighing about 400 lbs. onto the pump base-plate. Together, both employees then needed to align and center the drum as the pump was lowered onto the drum.

Solution: The BBS Steering Team worked with an outside vendor to develop a customized H frame with drum attachment for the Power Prime Pump. The new H frame would allow the drum to be placed on the floor and then stabilized so that the pump could easily be attached to the drum by one person. This design significantly reduces the ergonomic risk to the employee while also making the task easier and more efficient.

Measurable Outcomes: The design modifications to the existing Power Prime Pump has helped to reduce ergonomic risks for employees performing this task by more than 70%. Additionally, the new design has increased productivity by 86%; what used to require two employees can now be done by one employee in a fraction of the time.

Workplace Solutions I (Team-Driven Workplace Solutions)
Booth # 413
Mass Cutting Device
The Estée Lauder Companies
Markham, Ontario, Canada

Presentation Description: The Estée Lauder Companies' Bentley manufacturing facility in Canada produces cosmetics products for many brands within the Company. Employees were using a one-handled knife to cut blocks of lipstick mass into smaller pieces before being placed into a melting kettle. A two-handled knife was later introduced to alleviate the strain from using just one hand, however the ergonomic risks still existed while performing this task.

Problem: The cutting of mass for lipstick production has been identified as a high-risk task for employees. While the introduction of a two-handled knife improved the situation, the ergonomic risk still existed for this task that is performed about 50 times per day.

Solution: The site's BBS Steering Team consulted with a maintenance team member to review how the cheese industry dealt with cutting blocks of cheese. A prototype was developed in-house using a wire frame to cut the blocks of lipstick mass. The idea of using a vertical lifting table to lift the block of lipstick mass through a wire frame resulted in the final design.

Measurable Outcomes: This multi-phase employee-led effort resulted in a lipstick mass cutting device that has reduced ergonomic risks by 67%. Additionally, the new lipstick mass cutting device resulted in a 60% productivity improvement for this daily task, converting a manual process into a much more efficient one.

Workplace Solutions I (Team-Driven Workplace Solutions)
Booth # 415
Stepanquat GA-90 (Ammonyx) Handling
Estée Lauder Companies - Aveda Corporation
Blaine, MN

Presentation Description: The Estée Lauder Companies' Blaine manufacturing facility in Minnesota produces cosmetics products for many brands within the Company. Enhancements were made to the handling of Stepanquat GA-90 (Ammonyx), a raw material use frequently at the site, to improve ergonomics and industrial hygiene.

Problem: The method of handling Ammonyx, a volatile organic compound (VOC) raw material, was identified as having a high ergonomic risk as well as a high personnel exposure risk. This material arrives on-site in a 55-gallon drum and has a lard-like viscosity. Employees would use their hands to scoop the product out of the drum, reaching their head, hands and body into the drum in order to remove it all. Along with the identified ergonomic risks, the material must be handled in a controlled environment and there are limitations as to the types of devices that can be utilized in this work area.

Solution: A cross-functional team of employees evaluated a number of different ideas. An air line attachment was built to connect a stainless-steel tube to a hose using filtered air at 20 psi. The stainless-steel tube fits the full length of the drum and has a slit cut into it in order to fan the air across the side and bottom of the drum evenly, releasing the Ammonyx from the drum. Over the course of several years, a number of alternative solutions were developed in-house and tested. Roughly $20,000+ was invested in solutions that ultimately failed; this new tool was made in-house for only $200.

Measurable Outcomes: This employee-led effort has resulted in an ergonomic risk reduction of 85% along with greatly diminishing the employee exposure to VOC while working with the material in the drum. Additionally, productivity has increased by 99.6% - what used to take nearly two hours now only takes 30 seconds and allows for more of the material being recovered from the drum.

Workplace Solutions I (Team-Driven Workplace Solutions)
Booth # 417
Radar Love

Honda Manufacturing of Indiana, LLC
Greensburg, IN

Presentation Description: With Honda's commitment to a zero-collision society by incorporating a standard safety feature using radar technology called Honda Sensing, the radar install process for the Honda Insight model initially required an extremely high insertion force of 76.6 pounds to assemble. After testing four types of presses, the team found success with associate feedback and a salvageable arbor press that reduced the installation force to 4.3 pounds. Significantly reducing the force requirement by 95% resulted in the elimination of risk for an overexertion injury. The team can now safely build high quality cars with a cost avoidance over $250,000.

Problem: The difficult assembly of the milliwave radar to the bracket caught the attention of an associate during an early new model build event back in the summer of 2017. The installation method required the use of one arm exerting 76.6 pounds of force to set the radar in place. This put extreme amounts of pressure on the wrist (palm) and shoulder that were also in awkward postures. Awkward wrist posture at 90? extension and shoulder extension at 20? were required to muster this amount of strength. The insertion force and the poor postures exceeded acceptable limits specified in the Honda Ergonomic Guidelines. With the production goal of 180 units per day, the process became a perfect recipe for injury. The design of the radar and the retention clips did not allow these parts to withstand the extremely high setting forces, resulting in radar failure and broken clips. Associates also had to rush during the build events to ensure a good set and perfect quality.

Solution: The team trialed four different presses, but they had little success. The team continued to persevere until they found an engineering control to help alleviate the force required to assemble the milliwave radar. Hand setting with a 3D printed fixture only benefited quality and had negligible reduction in the setting forces. The 3D printed fixtures attached to the lever press reduced the setting force by 60% from 76.6 pounds down to 30.7 lbs. The lever press also eliminated awkward postures in the shoulder and wrist, previously seen with just the hand fixture. However, the lever press still exceeded acceptable forces. Finally, the team found an arbor press that was not in-use nor had a plan for its future use. The team then attached the set of previously printed fixtures to the press, bringing about the dawn of "Radar Love". With only 4.3 pounds of force to set all three radar clips to the bracket, a 95% reduction in installation force and with much better working postures at that, associates will no longer be at risk for overexertion injury.

Measurable Outcomes: From a safety perspective, the use of the Radar Love arbor press has eliminated potential injury by reducing the amount of installation force from 76.6 pounds to 4.3 pounds, a 95% reduction. The Radar Love press is an ergonomic solution that eliminates overexertion risk and awkward shoulder and wrist postures.

From a quality standpoint, associates are now able to set all three clips using minimal installation force that ensures the complete function of the radar for our customers. Since the press has been lineside, there have been zero broken retention clips and zero radar repairs.

From a delivery viewpoint, the process takes 3 seconds less per radar install with the Radar Love press. At 180 radars assembled each day, this saves approximately 9 minutes. This equates to potentially building more front-end modules, decreases associates rushing and decreases wasted motion at the process, a necessity for lean manufacturing.

From a cost standpoint, a total of $1,865 was spent on five different variations by using in-house design and repurposed parts. The team estimated that Honda Manufacturing of Indiana's cost avoidance was over $250,000 through injury prevention, quality savings and one extra manpower due to the reduction in process cycle time. The return on investment was almost immediate (approximately two days), which is very favorable to the company.

The Radar Love arbor press proves to be an associate favorite due to its simplistic design and ease of use.

Workplace Solutions I (Team-Driven Workplace Solutions)
Booth # 419
Knuckle Cart

Honda of South Carolina
Timmonsville, SC

Presentation Description: Installing a rear knuckle assembly on our Side-by-Side's here at Honda of South Carolina places many ergonomic stressors on the associates. Not only are the knuckles heavy (ranging from 28 – 32 lbs.) they also have 8 connection points that are difficult to maneuver into place while under load. This process has been proven a pain for our associates posing back soreness as this exceeds lifting and carrying guideline points accompanied by contact stress to the thighs as parts are held in place. The focus point for our team was to reduce the lifting and carrying risk but exceeded the target by removing all risk factors from the process.

Problem: The knuckle assembly on our SXS units range from 28 lbs. ~ 32 lbs. The knuckle and A-Arm was assembled on a sub table before being hand carried 4 feet to an awaiting SXS unit for installation. Once carried to SXS unit, the assembly is then held in place with both hands and resting on the associate's thigh while bolts are installed. This static posture was held for an average of 8 seconds per unit. The transportation of the knuckle assembly is a yellow rank task due to weight and walking distance. Also, during assembly, the associate had to hold the knuckle in place with their thigh to align bolts. This poses yellow rank contact stress on the thigh. Back discomfort was also noted, as we require associates to hang 2 knuckles per unit at a rate of 280 per day.

Solution: A knuckle assembly cart was designed by an in-house team and installed on our SXS line. The knuckle cart allows knuckles to be fully assembled from piece parts and rolled into place for installation onto the SXS units. This cart holds the knuckle at the correct installation height to eliminate the static posture and the contact stress places on the thigh. After the Knuckle has been installed successfully, the fixture cart can then be rolled back into its docking station for the next cycle.

Measurable Outcomes: Safety- Fully assembled knuckles no longer have to be lifted from an assembly fixture and carried to the SXS unit for installation. Thigh contact stress has been completely removed from the process. Associates no longer have to use their thigh to hold the part in the process. 100% of the ergonomic risk factors have been eliminated from the knuckle installation process.

Quality – As associates are holding the assembly in place as parts are aligned, fatigue sometimes causes the associate to misalign parts cross-treading bolts, and on rare occasions, parts are dropped to the floor. The cart improves alignment which in turn prevents the cross threading of bolts and eliminates the fatigue that causes parts to be dropped.

Delivery- A reduction of 6 seconds of process time occurred due to the implementation of the assembly cart. We have also noted an overall department efficiency up of, as the knuckle; install process was one of the department's bottleneck processes.

Cost- The assembly cart was built in house by our machine shop fabrication team. Scrap material was used in the design, however the final design cost $187 to build (Materials and Labor) ROI was less than one working day just counting process efficiency up. The reduction in the wasted 6 seconds in process has a direct cost of savings of $48,384 annually. An average of 2 units a day effency up due to the line not stopping in this process area for a profit increase of $12,000 Along with avoiding the potential of a back and contact stress related injury.

Morale- The affected associates were very interested in the problem-solving process and were involved in the entire process. Being involved in the problem-solving process that improves your job and allows you to go home feeling painless is a reward in itself.

Workplace Solutions I (Team-Driven Workplace Solutions)
Booth # 421
Pack Crate Fixture

Honda of South Carolina
Timmonsville, SC

Presentation Description: In the Side-by-Side pack department at Honda of South Carolina, in the crate transfer process an associate must unstack and move shipping crates from a supply conveyor to a unit load ramp. This manual process is accomplished by using a crate lifting fixture attached to an overhead hoist system to relocate a packing crate to an awaiting unit for packing. The original lifting fixture was not designed with the work envelop in mind. Our teams focus was to reduce the lower back fatigue in the process and increase productivity.

Problem: The original crate lifting fixture was designed to be operated inside the 37" to 47" range however as we begin lifting crates off of the stack, we got below the designed lifting range and back flexion reached 90 degree while loading the bottom 2 crates. In an 8 hour, shift 24 crates fall below 18" that is below our ergonomic guidelines minimum working height. The crates have to be moved to the loading area, crate is dropped off and the fixture is removed from the crate and returned for the next load. This creates 48 at risk cycles per shift. We have had associate complaints and nurse visits from this process.

Solution: The newly designed fixture was implemented to allow ease of adjustment to accommodate varying lifting heights. A pull pin and fully adjustable handle was added to the fixture to allow the tool to be adjusted with each lift to keep the handle within a proper lifting range.

Measurable Outcomes: Safety - The ease of adjustment with the improved fixture allows an associate to maintain proper back posture while completing the daily lifting task. The risk of a back injury or strain has been reduced in the crate load process.

Delivery - With the use of proper body mechanics, a reduction in process time of 12 seconds equates to $1.68 per unit savings. $235.20 per shift. $470.40 per day. $112,896 savings per year in process efficiency up

Cost - The carrier lifting fixture was built in our fabrication shop and implemented in process for $254. The process savings alone payed for the improvement in less than 9 hrs. of production.

Morale - The associates were empowered through the process of designing a fixture that increased the process safety, ergonomics, and efficacy. The implementation of this fixture shows that HSC and Honda respect each individual and associate buy in is important in any decision.

Workplace Solutions I (Team-Driven Workplace Solutions)
Booth # 423
THAAD Missile Canister Shock Isolator Compression Tool
Lockheed Martin Missiles and Fire Control
Camden, AR

Presentation Description: New tooling (compression lever) was designed, prototyped, built and introduced into the functionality testing of the Terminal High Altitude Area Defense (THAAD) missile canister hydraulic shock absorber cylinder. Incorporation of the new tooling significantly reduced injury risk associated with high manual forces exerted in awkward postures and significant contact stress while improving both accuracy and repeatability of functional testing results.

Problem: Functional testing of the missile canister hydraulic shock absorber cylinder is an integral step which has to be performed a number of times during the manufacture and assembly of the THAAD missile. To accomplish the functionality test, the assembler was required to apply 82 lbs. of pressure using the palm of his/her hand to push down and fully compress the hydraulic shock absorber cylinder. The cylinder is oriented vertically and is located between the assembler's shoulder and chest height. This meant that the assembler was not able to leverage his/her weight to compress the cylinder, but instead was required to assume an awkward "side bending" posture, extend the arms and brace one hand on the sharp edge of the lower canister frame, while fully abducting the opposite shoulder (with elbow in the air) and press down generating approximately 82 lbs. through the palm of his/her hand until the cylinder was fully compressed. The posture and force required posed significant physical risk to the hands, wrists,

elbows, shoulders and back. The awkward posture also made it difficult for the operator to see if the cylinder was fully compressed during testing, which posed quality and reliability concerns.

Solution: A team comprising Tool Design, Manufacturing & Engineering, Inspection and Assembly personnel were initially trained to recognize ergonomic-related injury risk and potential ways to mitigate that risk. The team then worked together to design, prototype, build, test and introduce targeted tooling and process improvements into the hydraulic shock absorber cylinder functionality testing process. The multifunctional team reviewed the testing process, identified opportunities for ergonomic enhancement and developed an initial concept for improvement. Tooling engineer developed a prototype compression tool which was trialed with the assemblers and inspectors. Design was optimized based on assembler feedback, and the improvement was introduced into the process.

New Shock Isolator Compression Tool was fabricated, and usage instructions created, along with training requirements for safe operation of the tool. Tool was trialed and validated using Engineering Use Only hardware before being delivered to employees for integration into production.

New tooling consists of a lever, with comfort-grip handle attached to a small housing which easily clips onto the canister frame. Once attached to the canister frame, the handle is presented directly in front of the operator at about shoulder height. Standing in a relatively neutral posture, the operator is able to pull the handle straight down, applying approximately 4 lbs. of force over a travel distance of about 6 inches, while being able to visually verify that the cylinder fully compresses under the force of a beveled pin which is attached to the lever at a point near the fulcrum. The lightweight tool easily clips in and out of the canister frame, allowing the single tool to be used to test the multiple cylinders located at different places on the canister frame.

Measurable Outcomes: Exertion of very high forces (~82 lbs.) under awkward back, neck, wrist and shoulder postures was eliminated and replaced with a process requiring the application of only 4 lbs. of force from a more neutral position of strength and control. This resulted in a score reduction using the BRIEF Survey screening tool from 14 (high risk activity) to 2 (low risk). Implementation of the improvement also significantly reduced the associated contact stress and potential bump and laceration injury risks, yielding a projected annual cost avoidance of more than $69,600 in addition to providing a more accurate and reliable testing process.

Workplace Solutions I (Team-Driven Workplace Solutions)
Booth # 425
B.R.A.T (Bearing Removal Assistance Tool)
Mercury Marine Plant 15 Assembly
Fond du Lac, WI

Presentation Description: The Mercury Marine Plant 15 Assembly Ergonomics Team will show the improved process of removing a bearing from a Bravo Gearcase for shim adjustment. Through the implementation of this new tooling, we have decreased the ergonomic risk by 74%. Prior to implementation of the new tool, the bearing had to be removed with a slide hammer.

Problem: The bearing has to be installed prior to taking the rolling torque reading. If the rolling torque does not meet specifications, the operator must remove the bearing with a slide hammer to access the shim stack. This process was assessed with the Humantech assessment tool and had a rating of 42. The whole-body assessment tool highlighted high elbow and shoulder risks.

Solution: After assessing the operation the Plant 15 Assembly Ergonomics Committee discussed potential solutions. Initial thoughts were to utilize a basic bearing puller, but we found that an off the shelf type tool would not meet our needs. After studying the geometry and discussing numerous design possibilities with the Mercury Marine Tool Engineering Group we came up with a design for a bearing puller that fit our needs.

The team trialed three iterations of the tool before finding the correct solution. The operator locates the jaws on the bottom lip of the bearing while locating the upper block, so the bearing pulls straight out. The center bolt is tightened until there is no slack remaining and then the operator puts a ratchet on the bolt and turns it until the bearing pulls out.

The team then decided to try and remove the demands of this task completely by utilizing a power tool to

remove the bearing. Through trials with the power tool we realized that this created unwanted early failure with some of the components of the puller. We are currently investigating other variable tooling for this process.

Measurable Outcomes: Ergonomic assessment follow up showed a 74% decrease; from 42 to 11.

Reduced grip forces from 65# on the slide hammer to 9# on the new tool.

The old process time was 45 seconds depending on the bearing removal; the new tool takes 15 seconds per bearing removal.

Total cost of the tool is @$1000.00. The elimination of the risk for a significant shoulder injury as well as the cost of a lower unit failure in the field gave us an ROI of 4255%.

Workplace Solutions I (Team-Driven Workplace Solutions)
Booth # 427
Electric Arc Furnace Tap Hole Sanding
Nucor Steel Gallatin
Ghent, KY

Presentation Description: This presentation will describe a homegrown improvement to relieve an operator from picking up 50-pound bags of sand and throwing them down a hole. The solution was generated and manufactured by the operators and maintenance department.

Problem: Background: The Electric Arc Furnace can hold 200 tons of molten steel. In order to keep the molten liquid in the furnace and to allow the furnace to pour out the liquid steel when needed, sand is placed in the tap hole as a temporary plug.

Problem Description: Sand is required to plug a hole in the furnace. The sand comes in 50-pound bags and has historically been placed by hand and required 6 bags for each job. These bags had to be thrown 6 feet to hit the mark. The problem is picking up a 50-pound bag and throwing it into location, 6 bags at a time, 30 times a day.

Solution: The solution to hauling 6 bags of sand to the furnace was a hopper dispenser attached to a fork truck. The hopper can hold the 300 lbs. of sand and is guided in place by a fork truck. One teammate will grab a hose from the bottom of the hopper, turn a lever and guide the sand in the hole. After the hopper is empty it will be filled by another hopper with a lever, no lifting of sand bags is required. The solution was generated by the teammates doing the job and the maintenance department. The solution was created using in house materials.

Measurable Outcomes: The outcome of this solution is elimination of risk from pickling up 50 pounds at a time, 6 bags at a time, 30 times a day.

The 50-pound bags are no longer stocked; super sacks are brought in and placed by fork truck. Super sacks are more cost effective than 50-pound bags.

Workplace Solutions I (Team-Driven Workplace Solutions)
Booth # 429
Chair Hauler
Wegmans Food Markets
Rochester, NY

Presentation Description: Wegmans Event Services organization is responsible for set up and breakdown of over 150 events a year. We moved over 900 banquet chairs in stacks of 10 using a hand cart. The tasks involve awkward postures while exerting high forces for hours at a time resulting in fatigue, injuries and operational inefficiencies. We constructed a chair hauler mounted to a power jack that moves 4 stacks at a time. Hours of work is now performed in 20 min with little stress on the body. The job is now done efficiently and safely by any employee on our team.

Problem: Wegmans Event Services organization is responsible for set up and breakdown of over 150 events at our banquet hall a year. We have over 900 banquet chairs in our inventory which we manually moved in stacks of 10 using a hand cart. Each chair weighs 17.45 lbs. for a stack total of 174 lbs. It takes approximately 35 lbs. of pull force to load the stack onto a hand cart (see picture #1). The carts can be difficult to use, forcing you to balance the chairs on the cart's two wheels. If you are a shorter person, the cart is especially tricky to operate since you have to hold the top chair with one hand to balance the stack. The stack can tip very easily especially when moving it over dock plates and floor thresholds if the employee doesn't apply enough force to control it. It was very time consuming when we had to move a lot of chairs and took 1-2 people hours to move them from storage to the banquet hall. This has resulted in injuries, operational inefficiencies and fatigue. After moving 900 chairs with the hand cart staff would be very tired and some experienced soreness for a day or two. We used REBA to analyze the three tasks in chair moving (loading, moving & unloading). Final scores ranged from 11-12 which are considered a very high-risk level needing immediate action.

Solution: We decided it would be easiest if we could construct a platform that would sit on one of our power jacks to move up to four stacks of chairs (total of 40 chairs weighing 698 lbs.!) at a time. Using spare material, we had around our shop, we constructed this platform at virtually no cost (see picture #2). After testing the prototype, we added a strap (in addition to the original lip) to ensure the stacks can't fall off the chair hauler. Additionally, we added handles to help our staff easily attach/detach and store it.

Measurable Outcomes: It would take one person almost two hours to move 900 chairs across the banquet hall with the manual chair cart. With the chair hauler that same person can move all the chairs across the building in about 20 minutes. This resulted in an 83% efficiency gain! We no longer drop chairs off the hand cart when going over thresholds which improves chair quality and improves safety. By eliminating the need to pull individual stacks onto the hand cart, manually pushing/pulling the stacks into position and the pull force needed to safely unload the stacks on the floor our REBA score was reduced to 2 for each task, showing a significant reduction in MSD risk. The job can now be done efficiently and safely by any employee on our team.

Workplace Solutions II (Engineering/Ergonomist-Driven Workplace Solutions with internal competitions)
Booth # 422
The Mold Changers
Honda of America Mfg. Inc.
Marysville, OH

Presentation Description: Honda associates frequently test and implement New Model vehicles into the mass production environment. During this process, associates often change the molds for the machines that friction weld the airbag hinge and AC duct to the dash. The previous mold change method required associates to drive and position a forklift next to the machine and manually push a 1,200-pound mold from the forklift on to the machine. This method presented massive ergonomics risks and safety issues from high push/pull exertions and awkward postures. The project team designed a mold change cart and storage rack system to improve this process substantially.

Problem: Three associates have to manually push and pull 1,200-pound molds onto a forklift when manually changing molds for four vibration weld machines during new model activity. One of these three associates also need to be a qualified and skilled forklift operator, who needs to be available during the weekends, which is when these mold changes typically take place. This process exposes these associate's ergonomic risks, such as 750 pounds of push force to load the mold into the equipment, resulting in numerous complaints of strains and sprains. Aside from strains due to manual pushing and pulling, there is also a safety risk associated with entrapment between the mold and machine. This process also takes about 4 hours to complete for the three associates performing these tasks (a total of 12 man-hours). There is also the potential to drop and damage the molds during this process, which then results in severe downtime situations. A damaged mold can also cause improper welding of the airbag hinge; which could then lead to premature airbag deployment. The mold change process occurs an average of 80 times per year (about 3 times every 2 weeks), with more frequent changes during periods of the actual New Model launches.

Solution: The project team designed and built a height-adjustable tool change cart to eliminate the need to use a forklift. This cart height is adjustable by a hand crank or by using a cordless drill. The team also built a cart-machine linkage and frictionless roller system, to reduce the need to push a mold into the machine manually. The team added a storage system to properly store molds. Associates use this cart to change molds on four different machines and can continue to use this as the plant adds more machines. The team spent approximately $73,000 to design, develop and implement this cart and storage system.

Measurable Outcomes: The team was able to eliminate the ergonomics and safety risks with this height-adjustable tool change cart. Additionally, the use of this cart reduced the manpower requirements during mold changeovers from three to two. Based on an average of 80 mold changes per year plus the injury cost avoidance and the elimination of the potential damage to the molds, this project generates a total cost savings of almost $300,000 per year. Therefore, the return on investment for this project is about 3 months. Associates can use this cart with other molds not only for this Honda plant, but for other Honda plants as well. Other industries that require frequent changes of heavy molds can also use this cart concept.

Workplace Solutions II (Engineering/Ergonomist-Driven Workplace Solutions with internal competitions)
Booth # 424
The Fifth Element Filter
Honda Transmission Mfg.
Russells Point, OH

Presentation Description: During the transmission assembly process, production associates install element filters in each unit. Production associates would manually use their thumbs / fingers to press the element filters into the transmission unit. The repeated pressing of over 20 lbs. of force caused physical stress on their thumbs and fingers contributing to repeated injuries and worker complaints. The engineering team reviewed the process and ultimately developed a mechanical device to press the filter into position. This new device eliminated the ergonomic stress from thumb and finger pushing, and even improved quality during installation.

Problem: Production associates had to hand press / push element filters into the unit during the assembly process. The associates would use their thumbs and or fingers to push the filters into position requiring over 20 lbs. of force, exceeding our company push force guideline. The repeated pressing force caused several injuries and multiple associate complaints (4 reported first aid incidents at approximately $3200). Using the thumbs and fingers for the installation method also resulted in inconsistency in the proper alignment of the element filter in the transmission unit.

Solution: Original efforts to use fixtures on line to press filters using a palm press method caused new ergonomic risks to the shoulders due to reach distance and related forces.
The team continued to analyze line side devices to assist in the filter installation process to prevent the thumb / finger pressing risk. The final design was for the associate to set the filter to the mission in an alignment fixture, then engage a lineside mechanism to complete the filter installation. This mechanical tool eliminated the thumb / finger ergonomic force exposure. The force to actuate the mechanical arm is 5 lbs., which is in the Green range of our company force guidelines.
By primarily using in-house resources, the team was able to minimize the cost to develop, fabricate, and implement this tool to less than $1,100.00.

Measurable Outcomes: Using the new tool arm and fixture to press the element filter into position completely eliminated the repeated force exposure to the workers' thumbs and fingers. By eliminating the excessive finger/thumb force to a minimal hand/arm force value, production associates have not complained or reported any new injuries. This also eliminated time for investigating reported incidents and related countermeasure action (4 reported first aid incidents at approximately $3200). Morale improved as the filter process was no longer causing pain or discomfort. Quality improved from the consistent filter alignment and installation to each unit. With an initial investment of $1100 and injury cost avoidance and savings from injury prevention, the production process improved in S, Q, C and M categories provided immediate pay back.

Workplace Solutions II (Engineering/Ergonomist-Driven Workplace Solutions with internal competitions)
Booth # 426
Harness Installation Hooks and Spool
Sikorsky Aircraft Corporation
Stratford, CT

Presentation Description: New tooling and process improvements were devised, designed, prototyped, built and incorporated into the harness installation of the 53K rotary wing aircraft. Incorporation of the new tooling significantly reduced injury risk associated with overhead handling of heavy harness cabling and manipulation under awkward wrist, hand and neck postures.

Problem: During production of the CH53K rotary wing aircraft large harnesses have to be installed 80" above the cabin floor. To accomplish this, electricians first had to remove the harnesses the from the supplier's packaging and spread them out across four tables placed end-to-end behind the aircraft. Each 110 lb., 50' harness then had to be manually picked up one at a time by a minimum of six electricians and carried onto the aircraft in a team manner. Once on the aircraft and in position, the electricians had to lift the harness overhead and, while holding the harness overhead with one hand, connect the harness to the airframe using zip-ties with the other hand. Zip-ties are extremely difficult to fasten and remove while holding the harness above head. There were also quality concerns as zip-ties can chafe and cause damage to harnesses. Once each harness was secured with the zip-ties, an electrician secured them with permanent clamps and removed the zip-ties.

Solution: A team comprising mechanics/electricians, Manufacturing & Engineering, ESH and the harness supplier were initially trained to recognize ergonomic-related injury risk and potential ways to mitigate that risk. The team then conducted a structured improvement activity (SIA) and worked together to devise a process improvement concept. Manufacturing Engineering then worked with the supplier to design a custom spool on which the harnesses would be delivered.

The harness is now delivered on the custom spool, which is loaded onto a height-adjustable cart at the time of delivery and rolled onto the aircraft. The spool is lifted to the installation height by the electric lift cart and the harness is unwound as needed using an integrated braking system on the spool.

The team also designed, and 3D printed hooks backed with magnets. These hooks are placed on the airframe at the points of install and the harness is now simply laid into the hooks, eliminating the need for zip-ties. The harness now goes directly from hook to permanent clamp.

Measurable Outcomes: Implementation of the Harness Installation Hooks and Spool yielded:

- Significant efficiency gain, reducing the number of electricians needed to perform the harness installation task by 67% (from six to two).
- Labor cost-avoidance of $8K per aircraft, with a projected labor cost avoidance of $1.6 M over the life of the program.
- Significant reduction of injury risk related to an awkward lift, carry and sustained overhead heavy hold of the 50 ft harness. Injury risk assessed using the Ergonomic Job Measurement System (EJMS) was reduced from 90 (High Hazard) to 30 (Low Risk).
- Projected injury cost avoidance of $92K per year.

Workplace Solutions II (Engineering/Ergonomist-Driven Workplace Solutions with internal competitions)
Booth # 428
GFA Light Weight Drill Jig Lifting
PPG Aerospace
Sylmar, CA

Presentation Description: Two operators are required to move the Global Express and Challenger tools from the staging rack onto the Global Express and Challenger part and vice versa. The drill jig tool is bulky and heavy (50 lbs.) and the handle positions make it difficult for the operators to grasp from. Ergonomic issues with heavy lifting arise when handled inappropriately. The new tool fabricated is light weight (<10 lbs.) and can be easily carried, grasped from and moved by one operator.

Problem: Two operators required to move a heavy 50 lbs. drill jig tool. The tool needs to be placed on parts or on racks requiring lifting and arm extensions with the tool.

Solution: The project was outcome of an RCCA due to an employee injury that slipped and suffered a hernia while lifting the tool. Initially the team considered to purchase & modify a lifting device as well as a new racking system for the tools, but this would take up space and make it expensive. After a detailed review of the process, the team realized that not many designed features in the current tool are being utilized and if these were taken off this would make the tool much lighter.

A new fiber glass material tool was fabricated which only includes the necessary features for the operation it is used for. This new tool does not require two operators to lift & move the tool that weighs less than 10 lbs.

Measurable Outcomes: Before implementation of the tools the scores were high (lifting evaluation: 145 & NIOSH: 2,775) in our Ergonomic Assessment software in the IHMap System. After implementation of the tool the new risk score is 35.

Workplace Solutions II (Engineering/Ergonomist-Driven Workplace Solutions with internal competitions)
Booth # 430
Batwing
Toyota Motor Manufacturing, TX, Inc.
San Antonio, TX

Presentation Description: Toyota's Texas Plant engineers were asked to investigate multiple early WMSD reports in the Engine assembly line. Production Team Members (TMs) were reporting shoulder and back related concerns when having to place the SPS (Set Part System) totes onto the engine skillet.

Problem: Team member have to carry (3) SPS (Set Part System) totes which hold multiple engine parts to be installed. The Team Member must walk to the engine carrier and place the totes onto skillet for parts to be set on the engine. Totes are long and heavy (average 45 lbs.) and must be carried one at a time. Each engine requires 3 totes. Team Members have to walk about 15 steps to place totes. Due to the high physical demand of this process it limits the people who can perform the task.

Solution: Engineering proceeded to design and fabricate a movable system to assist Team Members to load the heavy totes from Chute to Skillet without lifting and carrying it around (270°). The system sits around the engine skillet and opens up like a "batwing" allowing the Team Member so simply slide the totes into the engine skillet then close the wings for the totes sit in the correct position so as it makes it way down the engine line the remaining Team Members can add the parts needed to the engine.

Measurable Outcomes:

- Cost of Kaizen $42,000
- Production savings $10,200
- Return on Investment 264%
- Payback in 67 days
- Total Annual savings $153,000
- Improves Team Member versatility
- Eliminated approximate 20 million lbs. of carrying weight per year
- Eliminate over 2 million walking steps per year.
- Increase Productivity

Workplace Solutions II (Engineering/Ergonomist-Driven Workplace Solutions with internal competitions)
Booth # 431
Fuel Line Vibration Isolator Pliers
Cummins Inc. - Jamestown Engine Plant
Lakewood, NY

Presentation Description: The presentation will be a multi-media booth with a few sets of the pliers to try out on our fuel lines. There will be a pc with a video presentation running, a backdrop, custom designed presentation table and some give away goodies for all participants.

Problem: A new fuel line configuration utilizes an isolator between the set of two lines for positioning and to reduce vibration.

The isolator material is rigid making it difficult to position onto the fuel lines and requires up to 44 lbs. of push force to install.

This creates excessive hand/wrist and forearm pinch and press forces associated with opening the isolator and requires an awkward hand/wrist posture.

Additionally, any blemishes on the fuel lines caused by the installation process are deemed unacceptable. Metal tools used to install isolator are likely to cause defects.

Solution: An innovative plier design, constructed using mostly 3D printed parts, which open the isolator prior to installation. This design eliminates the pinch forces associated with installation, reduces the push forces to less than 10 lbs., reduces repetitions, allows the operator to use a less deviated wrist posture and does not negatively impact the operator's cycle time.

This solution was featured in the 3D printer mfg., Stratasys, Newsletter; 3D printing solutions Brief, page 4

Measurable Outcomes: Ergonomic risk was lowered by 14 points, when measured using the HumanTech System. This can be translated into a cost avoidance savings of $69,594.00 in both direct and indirect costs, or a 12,217% ROI when compared to the cost to build/implement the pliers.
The new installation process reduces quality defects associated with repetitions and high forces being used to install the isolator.

Workplace Solutions II (Engineering/Ergonomist-Driven Workplace Solutions with internal competitions)
Booth # 432
Engine Pick End Effectors
Toyota Motor Manufacturing, TX, Inc.
San Antonio, TX

Presentation Description: Toyota Motor Manufacturing, TX, Inc. (TMMTX) is located in San Antonio, Texas and is home to both the Tundra and Tacoma pickup trucks and build over 100,000 trucks a year. TMMTX has 3 major variations of engines the V8, V6, and L4 engines that are placed in each pickup truck. Once all the accessories are installed to complete a full engine, the engine is the lifted up by a conveyor system to be delivered onto a truck frame. The conveyor system is a below chain lifting device called Engine Pick End Effectors which require locking mechanisms to ensure safe lifting are specific to each engine type.

Problem: When lifting the engines with below chain lifting devices it is critical that the locking mechanism is secured properly to avoid any potential of the engine falling. Because the locking mechanism fits tightly and gets in a bind this has created wrist and hand discomfort for our Team Members. The locking mechanism is tight and bind because of wear and tear from normal use and is not serviced in house. When the Team Member is using an end effector that is difficult to lock, they have to take extra motions, often times striking the end effector, to get it to lock properly. Therefore, the TMs do not feel confident in the locking mechanism and have adopted abnormal work to double or triple check the locked condition.

Solution: Engineer redesigned the end effectors for an easier locking mechanism to eliminate hand burden and the possibility of miss locking by re-engineering the inside and outside locking mechanism. The new end effectors have a new shape to the locking mechanism that is more durable against wear and tear from the process while improving the ergonomic hand placement. The Team Members have an easier time locking the end effectors on the engine and have more confidence in it locking properly.

Measurable Outcomes:

- Cost of Kaizen $21,326
- Cost of Repairs-New motor
- Injury savings up to $332,332
- Return on Investment 1458%

Workplace Solutions II (Engineering/Ergonomist-Driven Workplace Solutions)
Booth # 400
Auto-Bagger Easy Release Pole
Estée Lauder Companies Inc.
Bristol, PA

Presentation Description: The Estée Lauder Companies' Keystone manufacturing facility in Pennsylvania assembles and packages cosmetic products for many brands within the Company. Mechanics encountered an ergonomic risk while removing the excess bagging material from auto-bagger lines, due to the tension of the waste wrap around the core roll. The mechanics were using retractable knives to cut the thick excess wrapping away from the core, until it could easily slide off the pole. This had a high potential for ergonomic and cut/laceration injuries occurring from repetitive motions while using a retractable knife.

Problem: Mechanics were removing and replacing the rolls up to 5 times per shift. This task required that mechanics forcefully remove the bagging material roll core, cutting any excess film with a retractable knife while using a forceful downward motion (approximately 45 cuts per task).

Solution: A mechanic had the idea to drill a hole on both sides of the wrap roll disks and construct a thin removable pole device from a piece of PVC pipe. The pipe was cut into quarters in order to be thin and long enough to reach across the roll and through both drilled holes. A pin was then installed to hold the piece of pipe in place on one side. When the pole was removed, it left a roomy gap between the core of the roll and the excess bagging material. This allowed easy removal of the bagging material directly into the recycle bin, eliminating the risk of overexertion, as well as the use of a retractable knife.

Measurable Outcomes: This low-cost project achieved several benefits including a 100% elimination of ergonomic risk along with a 90% productivity improvement for this daily task. Additionally, the risk of cuts/lacerations while performing this task was also significantly reduced by eliminating the need for a cutting tool.

Workplace Solutions II (Engineering/Ergonomist-Driven Workplace Solutions)
Booth # 402
Low Weight Recovery System
Estée Lauder Companies - Aveda Corporation
Blaine, MN

Presentation Description: The Estée Lauder Companies' Blaine manufacturing facility in Minnesota produces cosmetics products for many brands within the Company. The Low Weight Recovery System was created to eliminate hand and wrist injuries that could occur when topping off low weight bottles with product.

Problem: Finished product bottles sometimes have low fill weights. Employees were manually transferring product from one bottle to another. Employees experienced hand and wrist discomfort while holding and squeezing the bottles in order to transfer the product.

Solution: Based on employee feedback, a cross-functional team was formed to create a device that would automatically pump product from one bottle to another. Employees designed a system that allows for the low fill bottle to be set on a scale and then filled to the required weight using an automated pump. The system was built in-house and employees no longer have to hold the bottles, the product is transferred more quickly, and there is less waste throughout the process.

Measurable Outcomes: This in-house designed and fabricated low weight recovery system has achieved several benefits including an ergonomic risk reduction of 95% along with significant productivity improvements and higher production yields. What used to take multiple employees each more than an hour a day to perform this task now only takes one employee a fraction of the time with less waste during the overall process.