

# Ergonomic Program Improvement Initiatives

## EMCOR Group Inc.

### Improving Construction Safety Outcomes by Changing the Way We Work

**Description:** Our presentation describes EMCOR's efforts to eliminate overexertion injuries in our industry. The scale and structure of EMCOR demands that we persuade leaders at all levels to evolve from traditional work methods. Productivity became our focus and our approach was education, communication, and the provision of innovative tools. Our presentation will show: how we worked with our insurer to engage and educate thousands of leaders at all levels; our unique communications effort with its Changing the Way We Work or CW3 theme; artfully avoiding any negative perceptions of ergonomics; and the tools we developed to help our operations improve.

**Problem:** In 2007 EMCOR spent more than \$3.3 Million in claims (down 47% from 2004 but an increase over 2006) on 238 overexertion and repetitive motion injuries. In order to continue to improve in the face of an aging workforce we had to change the way we work in the field and incorporate ergonomic principles into the skeptical construction and facilities services industries.

## Ethicon Inc. (Juarez) & Ethicon Endo-Surgery Inc. (Albuquerque, N.M.)

### Reducing Ergonomic Risks Through Cross Facility Process Integration of Product Sampling

**Description:** This cross facility project was initiated due to multiple ergonomic issues while removing Finished Goods samples post-sterilization. These risks included bending forward, pushing and pulling to remove shipper from tote, and high hand grip forces while squeezing and pulling the shipper out of the tote at the Albuquerque facility.

Initially, an engineered solution in the Albuquerque facility was discussed. However, by working upstream in the process, the two teams (Albuquerque and Juarez) virtually eliminated the ergonomic risks and improved the customer driven process. Initial EJA data demonstrated a high risk score of 44 while the final resolution score was 8.

A collaborative effort lead to a streamlined process and significantly reduced the ergonomic issues while improving productivity in both facilities. A key factor to this solution was an understanding that a successful outcome can be created by various actions and combined efforts.

**Problem:** After the sterilization process, the sterilization technician had to open the boxes containing the Finished Goods samples and, due to the fact that these boxes were piled, they had to push, pull, and lift some boxes.

1. Technician had to support body weight with arm.
2. Bending forward more than 60 degrees up to 80 times per hour.
  - Back issues from bending
  - Leg issues from leaning on the conveyor support
  - Knee issues from hyper-extending over the tote
  - Awkward reach from actually retrieving the sample box
  - Hand grip force from picking up the boxes with fingers only (15 lbs)
  - Majority of negative employee response for process
  - Pushing and pulling forces to remove and replace sample box

## Ford Motor Co.

### Hose Connections Acceptability Ratings (HCAR) Process

**Description:** The use of digital human models (DHM) to perform geometric evaluations of hand clearances and reach zones has become common practice at Ford Motor Company. Moreover, DHMs have also been used for performing strength evaluations to ensure ergonomically acceptable jobs. A process called Hose Connections Acceptability Ratings (HCAR) was developed to establish insertion force targets in the early phases of product design. Once targets are set, design and release engineers provide design intent data to achieve sign off from manufacturing engineering. The process is complete when the hose efforts are confirmed at physical part validation build events. With hoses varying from size, shape, construction, type of connector, contained fluid and location on the vehicle; it can be difficult to accurately predict the posture an operator would assume to complete their task. Changes in the workstation, the parts or their packaging in the final product may trigger a reanalysis of the task. These challenges can result in changes to product in the later phases of program and process development. Inaccurate modeled postures can lead to incorrect hose insertion limits. The 5 phases of HCAR and the Analysis Method Filter will be discussed in detail.

**Problem:** High force issues plague the launch and builds of new vehicle launches. Once an issue is identified at the physical build, the team is very effective at finding an engineering solution. Since a physical part is already made this is really too late. The ergonomics team set out to try and identify high insertion force hoses BEFORE a physical build. The success of this process ensures that NO HIGH INSERTION force hose ever gets to production, minimizing the risk of injury to the operator, and design changes to the hose, process and facilities to aid in the assembly feasibility can be planned and optimized.

### **GE Healthcare Surgery ErgoCultivation**

**Description:** GE Healthcare Surgery manufactures mobile x-ray equipment. Achieved multi-year cultivation of ergonomics by:

1. Designing and implementing an ergonomic manufacturing production line that became a role model for five other production lines. Highlights an innovative employee designed ErgoKit that houses materials to build a multiple-stage x-ray imaging system. Employees learned and experienced ergonomic improvement through the use of the ErgoKit.
2. Designed and established an innovative employee training program for implementing ErgoKaizens that generated employee enthusiasm. Highlights an innovative employee designed portable ErgoLift for field service. In 2009, over fifty employee driven ErgoKaizens improved worker safety and ergonomic engagement.

**Problem:** We have had an Ergonomics Team for the last 8 years. As the Team matured and we achieved OSHA Voluntary Protection Program Star status, we realized that an effective ergonomics program requires employee engagement and support. Therefore, the Team assigned itself areas of the facility to coach and mentor employees in ergonomic principles and design. Out of this coaching, the Team developed the concept of ErgoKaizens (Quick Hit Ergo Projects) that helped promote ErgoCultivation. Before ErgoCultivation, employees lacked information on cause and effect of ergonomic improvements. The design of manufacturing processes required awkward and strenuous work positions. Instead of improving safety and preserving energy, work resulted in fatigue and injuries.

### **Joint Genome Institute Empowering Employees in Ergonomics**

**Description:** The Department of Energy Joint Genome Institute (JGI) is a facility that sequences plant and microbial DNA samples for partners worldwide for bioenergy, carbon cycling, and bioremediation purposes. Key attempts to eliminate injuries have been primarily driven by grassroots efforts of the staff. The staff with management support sought to develop ergonomic

and safety awareness, prevention and an education program to build solutions to reduce ergonomic risk and repetitive strain injuries. This presentation will highlight their successful efforts to prevent the debilitating and painful effects of ergonomic-related injuries in this highly repetitive production environment through training and educational resources.

**Problem:** Employees at the JGI, whether working in an office, laboratory, or both are faced with repetitive and detail-oriented tasks daily. Reports of discomfort and fatigue were common. JGI's culture promotes personal responsibility for safety, but communication, training, and education were not well aligned with promoting employee involvement in safety and ergonomics. JGI is a small division of 250 employees, but had a very high ergonomic-related injury rate. Employees were not empowered due to lack of communication and ergonomic resources to lessen risk and discomfort were not conveniently located, or available for use on a trial basis.

### **Pinnacol Assurance Office Ergonomics Computer Based Training Program**

**Description:** A computer based training program was developed by Pinnacol Assurance (a Colorado based workers' compensation insurer) for policyholders to educate their management and employees on basic office ergonomics principles, proper chair and workstation setup, modifications to eliminate discomfort, and ergonomics program development. Modules were designed to address not only seated computer workstations but also standing height workstations common in libraries, banks, etc. In addition to the training modules which incorporate video, audio, and on-screen text, downloadable resources were also included such as a FAQ document, a resources guide (with links to chair manufacturers that meet established ANSI standards, furniture, equipment, accessories, and software), and handouts on stretching, proper laptop setup, and guidelines for selecting ergonomic task seating).

**Problem:** Pinnacol Assurance insures 59,000 businesses in Colorado with 1.5 million employees. Providing training and education to a large and diverse population is impossible through individual workstation evaluations and policyholder training seminars alone. A computer based training program that could be used by policyholders onsite without requiring assistance from Pinnacol staff that was user friendly, did not require online access, could be used by any size employer, and was interesting and concise was essential for success. Purchasing an off-the-shelf product was not an option due to the cost and lack of flexibility and applicability to our target audience (e.g., standing height workstations).

### **Swagelok Co. Foundational Lean Program**

**Description:** The Foundational Lean process at Swagelok has evolved over the last several years into a unique continuous improvement culture driven through bottom-up ideas and improvements directly from the production floor. This lean process utilizes associate involvement, work center safety evaluations, CEDAC implementation techniques, 5S principles and overall productivity improvements. The presentation will briefly discuss the process evolution, and then illustrate the successful implementation with details from the Quick Connect assembly work center. This work center represents examples of ergonomic improvements reducing reach, part handling and repetitive motion while improving productivity by over 80%.

**Problem:** The original manufacturing engineering procedures for cell design relied on the knowledge and experience of the engineer. Unfortunately, this process did not allow for adequate feedback from production associates during the initial design and became an obstacle for future improvements.

## **Team-driven Workplace Solutions**

## **Bridgestone Cuts Like A Knife!**

**Description:** We installed cutter wheels that can be raised/lowered to trim off the edges of non-conforming rubber material to keep the workers from having to manually trim the edges with the use of a knife. This problem was identified as a potential ergonomic improvement item after an injury occurred. Now instead of a worker doing outstretched/overhead/ work using their hands, the cutter wheel is doing the job for them.

**Problem:** Teammates had to take a knife and cut off the edges of the rubber to remove non-conforming areas from the material. This task required outstretched and overhead body postures, and strenuous hand movements associated with grasping and utilizing a knife. This improvement opportunity was identified after the Banbury Department experienced an accident from a teammate engaged in this task.

## **Caterpillar Inc. Dyersburg Transmission Facility Transmission Case Ergonomic Solution: Eliminating Pinchpoints**

**Description:** This presentation will explain a safety/ergonomic problem experienced during motorgrader transmission assembly. It will highlight a significant ergonomic material handling problem and related quality issues. It will illustrate teamwork used to determine root causes, methods used to identify improvements, and finally; side benefits obtained in the form of cost savings. It will show in a presentation and demonstration format, the issues identified by the team in a before and after look at the operation. It will highlight in a quantitative format how each of the areas of People, Quality, Velocity and Cost were improved as a result of the changes.

**Problem:** 400 pound rear covers were delivered to the assembly line from the supplier in large parts tubs. When removing the covers from the tubs, prying, pulling, and manipulating created great risk for the associates asked to handle these parts. A recordable injury was caused when an employee tried to lift a cover that had slid partially into the tub. More serious injuries were inevitable if nothing was done. During the investigation, it was discovered there were also quality issues associated with damage during shipping and handling of these covers and there was a possibility the right solution could address both problems.

## **Elliott Co. Improved Method for Storage of Rotor Disks**

**Description:** The retrieval of turbine disks for assembly from the horizontal storage racks has become a problem area for the YR Rotor Assembly department. The racks were installed only a few years ago to provide convenient storage of the components however the racks have exposed the employees to a history of safety and health issues. In addition, employees often repeat these same steps multiple times for the retrieval of a specific part inconveniently located in the rack. As a result safety incidents and near misses are common and productivity has been affected.

**Problem:** In YR Rotor Assembly, blank disks weighing between 20 and 200 pounds were stacked and stored flat on pull-out shelves. It is physically challenging to bend and pull the drawers open by hand, which can hold as much as 2000 pounds of material, especially on the lower levels with the heaviest parts. The department has a history of work-related injuries from lifting and pulling, including 3 hernias in the last 2 years. In addition, since blanks are stacked, one top of each other operators must frequently bend and lift multiple disks to retrieve the correct piece for an assembly.

## **Elliott Co. Impeller Finishing Cart**

**Description:** Impellers for the Elliott centrifugal compressor line are fabricated through the joining of a top and bottom section by welding. The areas to be welded can very small to fit the welding rod to and in some cases the welding cannot be viewed by the operator. As a result the ability to maintain critical criteria such as bead size and bead smoothness are difficult. Elliott Company incorporates a finishing operation which essentially shapes and smoothes the welded joint to improve these criteria prior to inspection. The finishers typically are exposed to long periods of time operating a pencil type grinder to complete these operations.

**Problem:** The original impeller finishing station consisted of a stationary table equipped with a non-adjustable impeller fixture. In order for a finisher to work on an impeller, it was necessary to bend and reach to gain access to all areas of the part. In addition, the operator utilized a basic shop stool, which could not be adjusted for the height of the operator or the diameter of the part which can range from 10 to 36 inches. Impellers were delivered to the finishing stations flat on pallets via forklifts from the previous operation. This required the operator to bend over and lift the part in order to hook it up to a jib crane for placement onto the finishing station fixture.

### **Ethicon Endo-Surgery Successful Ergonomic Changes Provide Green Upgrade within Product Instructional Insert Handling Process**

**Description:** A newly implemented product instructional inserts handling process created a number of significant Ergonomic risks during a department relocation process. An overall ergonomic risk factor score by EJA was determined at 83.

Tasks driving these ergo risk factors included:

- Heavy insert holding bins
- Heavy insert bag weights
- Reaches and bends to insert storage drawer locations
- Pinching forces and wrist motions were placing strain on associates
- Twist ties and/or twisting bags created wrist posture and repetition risks
- Increased batch sizes yielded increased MMH weight
- Low visibility entering/leaving room
- Low visibility between rolling storage drawer banks

As a result of increased discomfort complaints and ergonomic review an action plan was created that would successfully reduce ergonomic risks, inventory discrepancies, plastic use, and cost.

**Problem:** Ergonomic risks experienced by associates included: MMH of heavy loads, reaching, bending, single arm lifting, repetitive motions of pinching/grasping/twisting and the accompanying use of improper tools, procedures, and guidelines. The ergonomic issues were leading to increased complaints of discomfort and first aid reports.

There were issues of poor visibility and congestion leading to safety concerns by having an improperly designed inventory storage room.

The down-stream resulting problems were inventory miss-issues and discrepancies largely due to having a new and poorly defined process.

### **Ethicon Endo-Surgery, S.A. de C.V. Ergonomics Excellence of a Medical Device Line through Lean Transformation**

**Description:** The original design of the Focus Medical Device manufacturing process posed significant ergonomic risks. Risk factors included reaching behind the body, shoulder abduction; lower back twisting, ulnar deviation, sitting posture issues, wrist twisting, and excessive walking patterns.

The key objective of this project was to implement practical changes to reduce ergonomic risk factors associated with the operators' movements, and at the same time eliminate waste from the manufacturing process.

A rigorous analysis of the original process was conducted as part of this line transformation project to identify and reduce ergonomic risks and hidden wastes to achieve the desired results.

**Problem:** The original design of this manufacturing process posed significant ergonomic risks. The team determined workstation designs that would allow for ergonomic risk factor reductions and eliminate 100% of all high risk operations.

The current manufacturing process was originally designed with both standing and sitting operations. The team needed to determine which working posture, sitting or standing, best allowed for the reduction of ergonomic risk factors. Considerations included tasks performed, frequency of tasks, and general associate populations for the region.

The team needed to baseline the current process and identify where waste could be eliminated. Changes in the process/workstation design needed to consider potential ergonomic risk factors, and produce no interruptions in the supply of this critical medical device to the customer.

### **GE Energy Closure Blade Installation - The "Lock Driver"**

**Description:** Integral covered steam turbine airfoil blades (like blades on a fan) are assembled in a circle around each stage (wheel) of a rotor shaft one by one starting at the assembly gate. Once all the blades are assembled, the final space is measured and adjusted to accept the final closure blade (lock) with a design-required interference. The resistive force caused by this level of interference was historically overcome with the use of a 16-pound sledgehammer, which can take up to 4 hours to install one lock. Now the newly created, gravity-driven "Lock Driver" completes this operation in 10 minutes, meeting design specifications and completely eliminating the sledgehammer.

**Problem:** For each stage of a rotor that requires Integral covered blades (ICB), the last blade (lock) requires significant drive in order to close the row to the designed compaction. Before the Lock Driver, the lock was driven in with a 16-lb sledgehammer. Operators had to swing the hammer up to four hours to drive a single lock. The assemblers who perform this task have complained of muscle fatigue, pain in upper body parts and intense upper body pain. Currently 40% of assembler injuries are ergonomic related. In the past eight years, Bangor has had three lost time injuries resulting in 126 days away from work and two injuries resulting in 235 days with restrictions. In the past 18 months, the assemblers have reported 11 injuries and only one has been ergonomic related.

### **Honda of America MFG Inc. / East Liberty Plant Improving Gravity-Feed Conveyor Roller Delivery Stations**

**Description:** Twenty years ago, the pin-style gravity-fed rollers installed at our parts delivery stations met the requirements of our single-model production facility. However, as the company added additional models to the production line, there was a need for more manual rearrangement of parts containers. Dragging containers across the pin-style rollers required high force exertions, increasing shoulder and back injury potential. Honda associates designed, fabricated and installed new roller ball racks to replace all delivery stations. This simple improvement had impressive results: manually moving parts containers with 90% less force, which reduces ergonomics stressors for 400 associates, all for less than \$12,000.

**Problem:** When Honda built its East Liberty Plant, it only manufactured one vehicle product on its production line. Twenty years later, the plant now produces three distinct vehicle products with various model types, but still uses the same delivery system. An electronic monorail system delivers parts bins to the line on vertical direction gravity-feed rollers. Associates then have to move the parts bins horizontally across the delivery stations rollers to position the containers close to the line location where associates eventually install these parts. Moving the bins horizontally across conveyor rollers at the workstation requires high force exertion (32 kg). This causes an increase in the ergonomic stress and the injury potential to the associates, particularly to the shoulders and back.

### **Honda of America MFG Inc. / Marysville Auto Plant Split Pin Benders**

**Description:** During the suspension assembly process, associates insert a split pin through a part and then use their thumbs to bend the pin to secure it in place. Associates install four pins on each of the 475 vehicles manufactured per shift. When a design change increased the split pin thickness, the bending force of the pin increased to 12 kg. Honda associates developed and fabricated a simple tool the size of a screwdriver to easily bend these split pins. The tool costs only \$10 to make, allows associates to use a whole hand grip posture, and reduces the force exertions by 90%.

**Problem:** Associates insert split pins through bolts and nuts, particularly for the suspension components of the vehicle, and then use their thumbs to bend the ends of these split pins around these fasteners to secure the parts in place. Associates would wrap tape around the thumbs of their gloves to cushion the localized stresses and to provide a perception of spreading out these forces. To ensure the thumb stressors were not too great on one process, the process engineers separated the split pin installation to two different processes. When a design change was made to accommodate better safety features in the vehicle, the thickness of the split pin thickness increased from 2mm to 3mm; hence, increasing the force required to bend the split pin with the thumbs to 12 kg. This manual force definitely exceeds the physical capabilities of most production associates and increased the risk for safety-related incidents. Not only did the process become more difficult to perform, but the time required for associates to complete these tasks also took longer. Bending the split pins manually with the thumbs became unbearable over time, and morale also suffered.

### **Honda of South Carolina Carburetor Stud Holder**

**Description:** Many applications throughout our assembly engine area require associates to use an anti-vibration gun to torque a bolt unto a unit. In several areas associates have developed trigger finger and (HAVS) known as Hand-Arm Vibration Syndrome. One particular area known as the carburetor stud installation is where the associate is exposed to both hands being vibrated excessively with palm force.

An ergo committee member recognized the severity of the associate's compliant and stress factors associated with the process. The ergo committee associate referred to the in-house ergo guidelines to developed a carburetor stud holder (simple, but very effective). This unit was tested and approved by management as a red rank process reduction.

This eliminated ergonomic stressors, decreased process time and improved quality by providing uniform results with each application.

**Problem:** This associate holds the carburetor in the palm of her hand while using an impact gun to insert two studs at a palm force of 23.1 lbs. In-house guidelines 15.5 lbs.

In addition the associate is exposed to 60 Newton meters of torque reaction from impact tool (which equals to 44 foot pounds) of vibration force. Ergo guidelines reflect force over 16.4 pounds to be a red rank process.

### **Joint Genome Institute Flip Your Lid**

**Description:** The Department of Energy Joint Genome Institute (JGI) is a facility that sequences plant and microbial DNA samples for partners worldwide for bioenergy, carbon cycling, and bioremediation purposes. The manual process of opening and closing 2 milliliter (mL) tubes is a high risk, repetitive task with a hazardous Strain Index of 7.3. Solutions to address workstation setup, modifications to protocols, and a tool design concept were initiated by production line staff. These solutions eliminated high force pinching and gripping of the 2 mL tubes and reduced the Strain Index to a safe score of 0.2.

**Problem:** The manual process of opening and closing 2 mL tubes involves using a two finger pinch grip. The high force needed to pry open the 2 mL flip-top tubes (up to 16 pounds of force) as well as the manufacturer-tightened screw-top tubes (up to 2.4 pounds of force) requires a two finger pinch grip up to 3.28 efforts per minute. Reports of discomfort and fatigue in operators were common.

### **Kaiser Aluminum Sniff Unit**

**Description:** Cleaning the underside of the Sniff Unit lid required operators to use a steel bar (approximately 20 lbs) at an awkward angle and resulted in shoulder and back symptoms being reported on a regular basis.

A cross functional team came together to solve this issue. A tool stand was invented to support the weight of the steel bar. An air tool was instituted to reduce impact forces felt by the employees. Lastly, the tool stand was modified to allow height adjustments.

The team successfully came together to create a process that can be performed by any operator quickly and safely.

**Problem:** The Casting department at Trentwood had experienced 2 recordable injuries from employees using a 6 foot pry bar to clean an aluminum build up from a furnace lid. The employees would clean the lid with the bar, approximately 12.5 pounds, above shoulder height and thrusting it forward. This action caused strain on the shoulder.

### **PPG Industries Cap Seal Filling Unit**

**Description:** New product line for trial - caps (known as "seal caps") filled with pre-mixed sealant and then frozen. The first production run for the customer required 5000 seal caps to be filled. This task was completed by using the hand-held trigger-action sealant dispensing gun. One seal cap filled per trigger action. With the possibility of ongoing high volume orders, it was decided to modify the filling technique to minimize the ergonomic risk to the operator.

The new dispensing design delivers the sealant material via an air-driven and foot-operated system. This design is effective in reducing the repetitive risk to the operator, simple and easy to operate, allows for a quicker preparation of each sealant cap tray ready for snap freezing (assists in maintaining sealant integrity) and allows a higher throughput of 2160 to 7200 filled sealant caps/day.

**Problem:** Trial product run for our customer required operators to fill seal caps by using a hand-held trigger-action sealant dispensing gun. One seal cap per trigger action filled. The first production run required 5000 caps to be filled with the possibility of ongoing high volume orders. Risk of repetitive and trigger action injury to operators.

### **Spirit AeroSystems Applied Leverage Tool**

**Description:** The study, experimentation and development of an Applied Leverage Tool allow any worker to perform an assembly tasks by increasing his or her physical strength significantly. The presentation demonstrates an innovative hand tool instrument which takes advantage of the structure and part to help leverage the power required to safely complete the manufacturing task.

**Problem:** Torque tool used to tighten down screws to 123 in. lb. could be used by few mechanics, and often resulted in arm and shoulder pain to the workers.

### **Spirit AeroSystems Breaker Maintenance**

**Description:** The Spirit AeroSystems Wichita manufacturing site is reliably powered through 170 breakers located at console substations throughout the site. Periodic breaker maintenance is performed as electricians check, clean, repair, lubricate and test (corrosion and power) each breaker. The presentation highlights the advantages of a mobile lift table and ramped and enclosed trailer that moves between substations and allows safe protection from weather elements and improves overall worker postures.

**Problem:** Facilities electricians work in extreme weather elements and in long durations of awkward postures while accessing and maintaining 12-volt and 4-volt breakers.

### **Toyota Motor Manufacturing Kentucky Ergonomic Improvement to Door Hinge Cart**

**Description:** T/m is lifting a 19lb. Hinge Jig. Maximum reach is 1790mm. Height of jig is causing poor posture. Arms are over-extended and above shoulders and wrists have an ulner deviation. Cart wheel is located on floor track which takes a push force of 16kgs. to return cart to home position.

- Lowered Hinge Jig down to same height as Camry Jig. Now the height of the stand is 1040,
- Developed a rotating cart that would automatically turn to allow both Jigs to be located within the workers comfort zone.
- Added Air driven assist to return cart to home position eliminating push force.

**Problem:** The door Hinge Jigs were located too high causing an extended reach and arms above shoulder. The Jig height caused a poor ergonomic wrist position and the cart weight caused a push force of 16kgs. to return cart to home position.

### **Toyota Motor Manufacturing Kentucky Pump Ring Removal Tool**

**Description:** Before - Metal Fuel Tank enters into paint station then through a dryer to dry paint. The tank then travels on conveyor to t/m where the pump ring cover must be removed. The excess paint built up on the cover required excessive force by the t/m to remove.

After - Tool was installed on a spring balancer to assist t/m's in removal of cover from painted fuel tank.

**Problem:**

- 16kgs of force to remove pump ring cover by hand.
- Hammer used to break cover free from paint.
- Damage to cover from use of hammer.
- Created bad ergonomic postures.

**Toyota Motor Thailand Co. Ltd. (Gateway Plant)  
Sliding Seat for Assy Transmission Shift Lever in Interior Vehicle**

**Description:** Sliding seat for assy transmission shift lever in interior vehicle due to human work wrong character sit on foots. In-house staff design and develop equipment for contribute to work easy and poor ergonomic improvement. Sliding seat is equipment for help human work in interior vehicle true operation and reduces to be exhausted.

**Problem:** Human difficult for assy work in interior vehicle.  
Human has weak point to be exhausted.

**Vesuvius USA  
Applying Antistick Coating to Ceramic Refractory**

**Description:** A cross-functional team of hourly, salaried production, and maintenance employees investigated, designed, and implemented an ergonomic solution for applying antistick coating to ceramic refractory pieces. The team assessed the current risks to employees with an Ergonomic Job Measurement System risk analysis. It investigated potential solutions, designed new equipment, developed new process instructions for operators, discussed the solution with operators, and implemented the solution. The team then made necessary refinements to the equipment and process, and validated that the solution met the ergonomic improvement expectations.

**Problem:** This process involved continuously and rapidly striking a piece of ceramic refractory with a two-pound rubber mallet for two to three minutes until the antistick coating solidified to an acceptable thickness. Multiple employees were processing an average of 560 pieces of ceramic refractory each week. An Ergonomic Job Measurement System risk analysis indicated that this was a high-risk task since the original procedures required a high frequency for repetitive motions of the upper body.

## **Engineering/Ergonomist-Driven Workplace Solutions**

**Bridgestone  
Innerliner Sensors "Coming to a TAM near YOU"**

**Description:** During the tire assembly process, innerliner material is let off from a loaded cart into a server. During this process, the innerliner has the potential to stick to the cart liner. When the innerliner sticks to the cart it can stretch the material the entire length of the server (13ft). This material must be manually removed by the operator and can weigh up to 40lbs. To reduce the potential for jam ups, a sensor was installed to assist in the removal of the material from the liner.

**Problem:** The rubber material coming from the supply department was sticking to the material liners while being dispensed from the liner roll. This was causing frequent jam-ups, stretched material, potential strains, and teammate complaints from having to remove jam-ups. This also increased the number of roll changes, which requires teammates to manually maneuver carts.

**GE Transportation  
Locomotive "Truck" Pull Device**

**Description:** The Torreon Rail Locomotive Repair shop performs servicing on locomotives. When servicing the locomotives, the “trucks” must be separated from the locomotive body. The “trucks” include the wheels and the support structure of the locomotive. Each locomotive has two trucks and each weighs over 66,000 lbs. Separating the “trucks” from the body of the locomotive required 8 employees to push them the needed 21+ feet, and required some of the employees to be positioned under the elevated locomotive body and between the two trucks that were being moved. The Torreon ergonomics team developed a method to replace this manual separation process using a pulley system and the existing overhead crane

**Problem:** During 2008, the Torreon Rail Shop employees experienced 39 sprain cases and 35 back cases. Based upon an analysis of the incident data, pushing the “trucks” was the task with the highest priority for resolution. Each truck weighs greater than 66,000 lbs and it took eight employees pushing with nearly maximal force to move the trucks. Each truck must be pushed out over 21 feet and then back in after servicing is complete. There are two locomotives serviced every week and each locomotive has two trucks. Therefore, in total, this task is completed 8 times per week. Prior to pushing the trucks, the locomotive body is raised using four high capacity hydraulic jacks. When pushing the trucks, several employees were working under the elevated locomotive body, presenting safety as well as ergonomic risks.

### **Honda of America MFG Inc. / East Liberty Plant Flexible Painting Fixtures**

**Description:** Honda’s East Liberty Plant manufactures three vehicle models on one production line, creating challenges for spray coating plastic parts. A common carrier system transports the bumpers and instrument panels through the plastics painting operations. Whenever a different part or model changeover occurred, associates had to manually install a heavy and awkward fixture to each common carrier. The team implemented a permanent modification to each common carrier that provides adjustability for all parts and models with a simple adjustment. This clever design eliminated the manual handling of heavy and bulky fixtures, reduced ergonomics stresses, and saved time and storage space.

**Problem:** Associates had to manually place part- and model-specific fixtures on a common carrier to hold bumpers and instrument panel shells during the paint spraying operations. These fixtures were heavy and bulky and had to be manually removed and then replaced for each model and part changeover occurring in the plastic painting operations. Additionally, associates manually push heavy carts that contained these fixtures. These manual handling tasks resulted not only in numerous ergonomic stresses, but were also time-consuming. Additionally, storing several carts of fixtures took up valuable storage space on the production floor. Historically, this fixture replacement process averaged two ergonomics incidents per year.

### **Spirit AeroSystems Small Nacelle Assembly Process**

**Description:** The Small Nacelle Assembly Process requires excessive knee flexion while accessing tasks on lower parts of a fixed strut in floor assembly jigs and pogos. Risk of shoulder and wrist injuries are also present when workers are required to perform assembly tasks while holding tools and accessing parts / fasteners while reaching from less than an optimum standing/prone position.

**Problem:** To minimize injury risk, access all around the unit and inside it was required while the assembly was mounted in a “nose down” orientation, and then rotated to aircraft attitude. This endeavor would require minimal scaffolding needs and addressing the manual rotation of this 400-lb unit.

### **Spirit AeroSystems**

## **Cut-Down Tilt Table**

**Description:** The Skin Fab Cut-Down Tilt Table is actuated electrically from a pendant control and employees stand outside the table footprint. Workers simply align the tilt table and A-frame trailer; then, the worker can simply push a button on the pendant to allow skins to be flipped from a horizontal attitude to a more vertical attitude (A-Frame transportation trailers). The table is designed to allow up to 800-lb skins ranging in sizes from 3'x12' to 9'x39'. The table is split to allow smaller skins to be flipped with only a partial section of the table. The entire table surface is used to flip larger skins.

**Problem:** Employees were frequently handling (up to 110 skins daily) large and heavy aircraft skins received from picture frame to a cut-down table and then to A-frame transportation trailers. Employees were at a high risk of ergonomic and physical safety injury as skins were manually lifted and maneuvered from a horizontal plane to varying-height A-frame transportation trailers.

## **Spirit AeroSystems Trunnion Install Ergo Design Improvement**

**Description:** A trunnion tool was designed and a powered torque tool implemented to transfer the labor-demanding (30 minute) task to one with mechanical advantages. A reduction in arm and shoulder injury was achieved.

**Problem:** Overhead work and strenuous manual torquing were required in the installation of a large bearing weighing 50 lbs. The bearing was fitted into placed in an awkward overhead position and a manual torque wrench was used to tighten the structure in place. This process was labor-demanding and placed excessive stress on the arms and shoulders. The task exceeded 30 minutes for one try at getting the required torque of between 11000-12000 in-lbs required.

## **Toyota Motor Thailand Co. Ltd. Improve Method of Changing Direction for Supply Dolly**

**Description:** Regarding to company's first aid record room, the operator was fatigue by pulling a part supply dolly to change the direction of movement.

The method was improved by installing a simple mechanism with theory of vector and gravity then there wasn't a need for power and pneumatic moreover; it's touch less by operator.

After improvement, the operators are not fatigued. This project has the origin concept of many ergonomics improvement projects of Toyota Thailand that do not require power supply.

Merits:

- Eliminate unsafe operation,
- Minimize investment and easy to maintain,
- Improve R&D skill of in-house engineering support staff.

**Problem:** Operator was fatigue by pulling a part supply dolly to change directional movement.

## **Trane Residential Solutions Pneumatic Prep Tool**

**Description:** In the processing of HVAC aluminum coils it is necessary to join the copper tubing to the aluminum coil. This requires prepping of the aluminum and the insertion of a transition tube. This is achieved by reaming the 3/8" aluminum tube with a drill bit designed to open the tube to the correct diameter. The operator must dip the drill bit in oil to prevent overheating and then use physical strength to provide enough force to open the tubing. With the participation of

the operators, we developed a pneumatic tool that oils the bit and reams the tubing with a simple push of a button.

**Problem:** Assembly line employee use elbows out, force, and shoulder too high to ream the circuits in this coil. Frequency may be as high as 3,500 circuits per 8 hour shift. This process has resulted in first aid reports from employees related to shoulder fatigue and strain as well as punctures to the hand from the drill bit.