



CRE-MSD

**Centre of Research Expertise
for the Prevention of
Musculoskeletal Disorders**

The Economics of Ergonomics

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Isn't the safety of workers enough justification for Ergonomics ?

- ❖ **Every Company needs to make profit**
 - ❖ Investment in products/ process that improve the profitability

- ❖ **Every company must provide a safe workplace**

What makes a company realize
Ergonomics can contribute to
profitability ?



Injury Risk to Justify the solution



- ❖ What's an acceptable injury rate ?
- ❖ Do you have to wait for an injury ?
- ❖ Probability of a past injured worker on future injuries
- ❖ Criteria of Injury Risk

Injury Risk is our area of Expertise :
Ergonomic assessment quantify risk

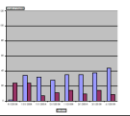


How does your Company Cost justify any changes?

- ❖ Managing Risk is part of accounting
- ❖ Compliance must be funded
- ❖ Probability of an injury is powerful

How does an engineer or management get funding for changes?

Most likely they use problem solving methods such as Six Sigma, 8D and Lean to demonstrate why the change is needed

6-PANEL		DY M A I C R
DEFINE VOICE OF THE CUSTOMER		
VOME	CORE Engineering	Customer: DTP
P415 Ergo Risk assessment	Ergonomic Process	
PROJECT CLASSIFICATION: Safety: Zero Red ergo issues. If all ergonomic issues were resolved there would be a lower injury risk associated with manufacturing of the Vehicle. The P415 has different injury rates at the two manufacturing facilities.	TREND CHARTS and BREAKDOWN OF ISSUE: Scoping Pareto of Customer Defects DTP has more OSHA recordable (blue) injuries than KCAP (red) with the same vehicle and same ergonomic standards applied	
VOICE OF THE CUSTOMER: Ergonomic injuries are coming from the P415 manufacturing facilities. DTP DART injury rates are higher than KCAP, which builds the same product and went through the same Ergonomic virtual process. CTQ STATEMENT (Customer Requirement): Identify the higher incident injury causing manufacturing jobs in each of the plants. Evaluate the jobs against current ergonomic standard to determine the root cause of the "injury" (defect). Also, compare the ergonomic risk predicted during virtual assessments, to actual ergonomic risk on the plant floor. DEFECT DEFINITION for Y (Objective Metric): A defect is defined as an operation with multiple OSHA recordable (ERGO) visits to medical. (Greater or equal to 3) COST OF POOR QUALITY: Injured operators that impact cost and vehicle quality. PROBLEM STATEMENT, SCOPE, AND GOAL: Analysis of plant operations with multiple OSHA recordable injuries against established Ergo criteria and improve workstation exposure to ergo risk by fixing current plant jobs.		

Corporate 6-PANEL Template version 3.3 ppt Page 2 of 20 Originated: March 12, 2002, Updated: April 29, 2009



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Injury Driven Process

- Is a good place to start.
- Treat the injury as a **defect** that needs to be solved.



Operator bending into bin to retrieve parts is a high risk of injury

What proves this is high risk? Compression of the spine

Part presentation (rack on floor) ,
Shipping rack design (2 side drop door)

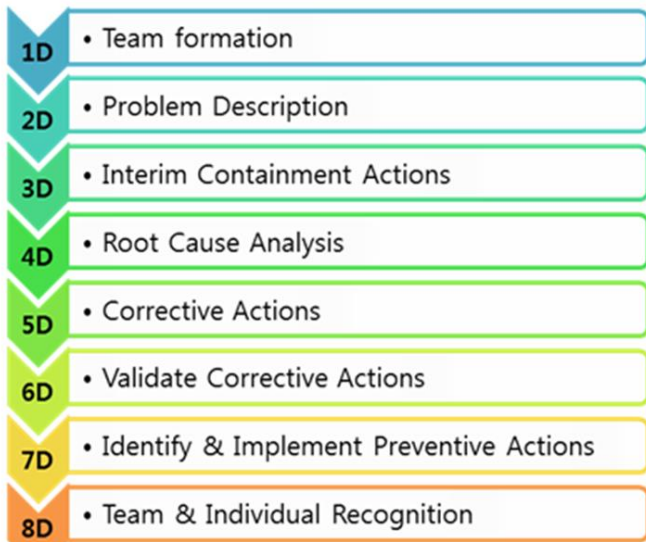


Figure 1: 8D Problem Solving Approach

Building trust in Ergonomics

Option 1:

Purchase cost:

Engineering cost:

Training cost:

Recurring costs:

Other costs of change:

Total cost of intervention: \$ - T

Effectiveness of solution:

- Eliminates exposure to hazard
- Reduces level of exposure
- Reduces time of exposure
- Relies on employee behavior
- No reduction in injuries expected

Productivity Improvements:

- High - speeds up entire process
- Medium - reduces wasted motion
- Low - improves comfort/reduces fatigue
- No productivity gains expected



Proactive Ergonomics

A good business process

- Company Culture
- Business Case :
 - *Safety
 - *Quality
 - *Cost
 - * Morale

Ford Motor Company Mission, Vision & Values

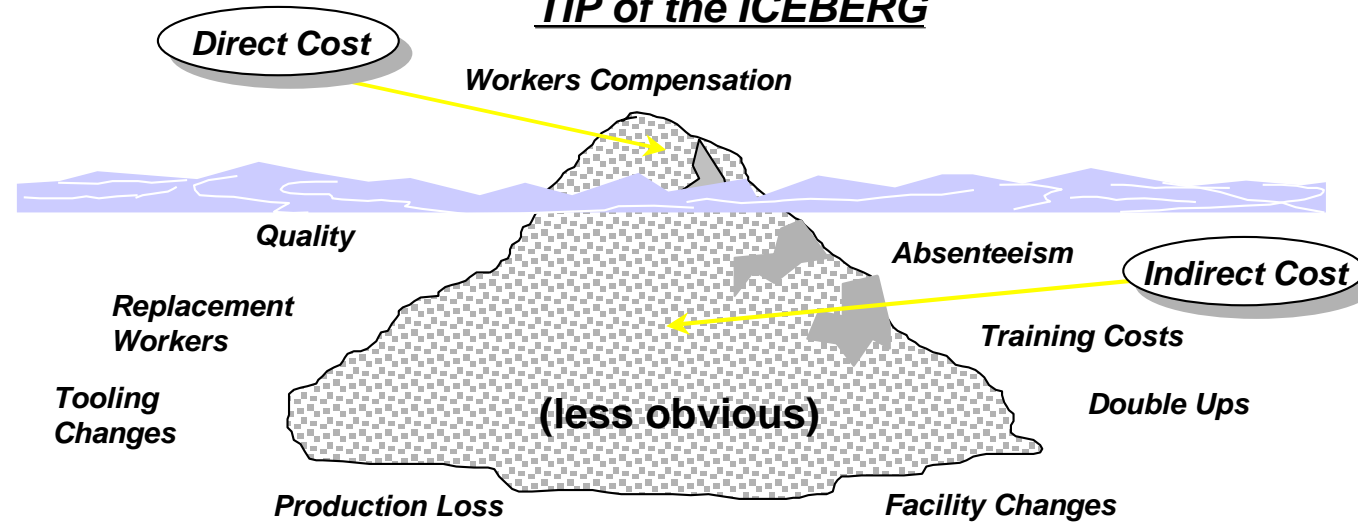
- Put People First.
- Do the Right Thing.
- Create Tomorrow.
- Play to Win.
- Be Curious.
- Built Ford Tough.
- One Ford.

Total Cost

TOTAL COST = 4 x Direct Cost

\$26 Million is only the...

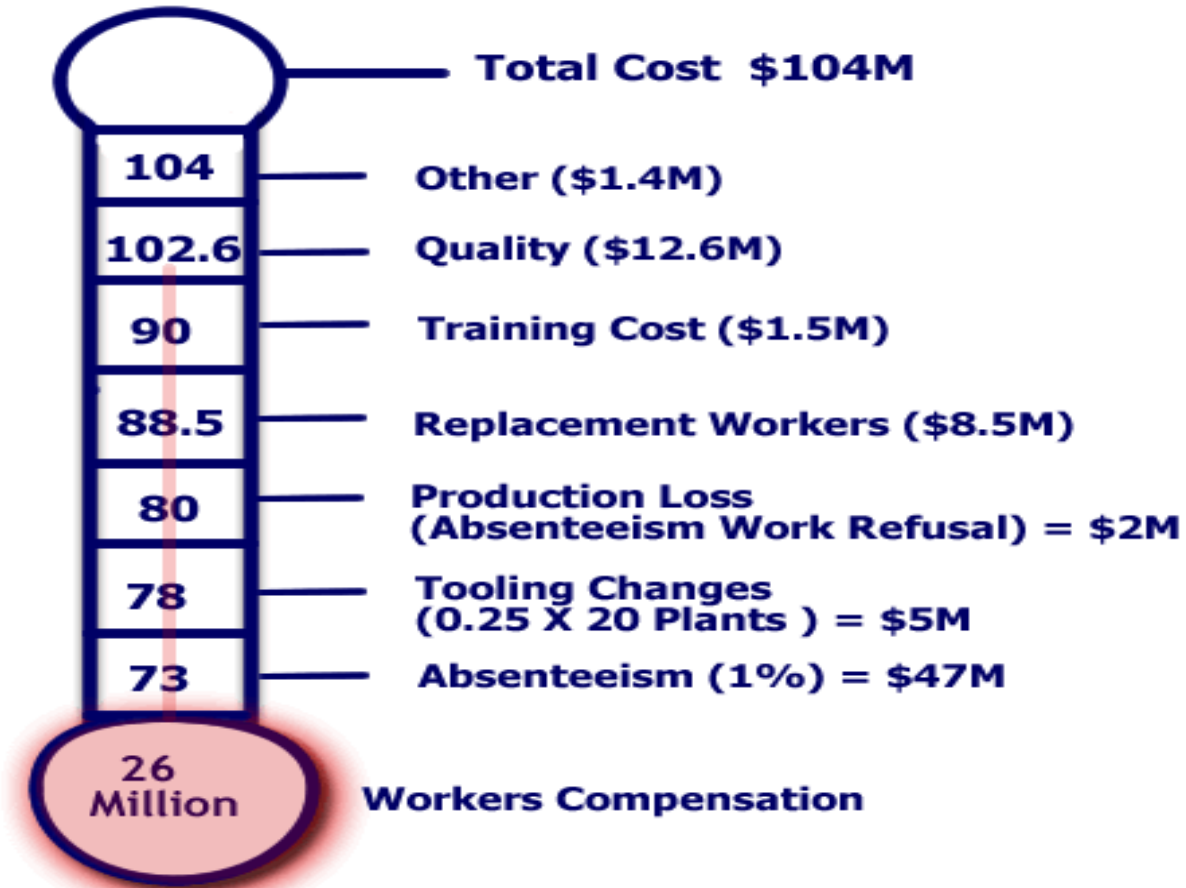
TIP of the ICEBERG



Total Cost is at least \$104 M

U.S. Only

Total Cost



Data based on 1999 and 2000 model year



Safety

- **Ergonomic Injury Rates ***

- 50% of Employees go to Medical
- 2,146 lost time cases/year
- 39,711 days away due to ergo injuries
- 20,000 employees injured (FTOV) in 2000

Equivalent to an ASSEMBLY PLANT being shutdown for 3 WEEKS!

* U.S. Assembly Plants

Quality

Weatherstrip Installation

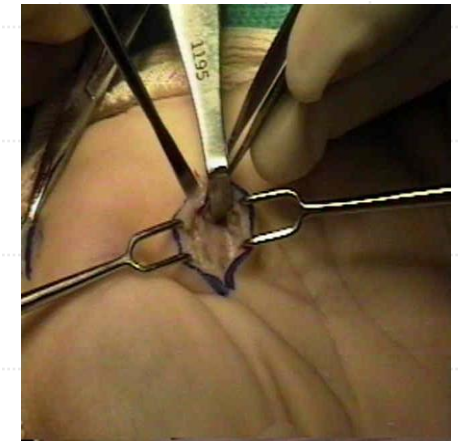


Windnoise/water leak TGW's

269 TGW on 2000 Explorer

Morale

- **Low Job Satisfaction**
- **Poor Quality of Life**
(Pain and Suffering)
- **Absenteeism**
- **If we continue to repeat *known* Ergonomic Issues – workers don't believe the company cares**



Move from find and fix to prevention



"I'll have an ounce of prevention."

- Prevent the Reoccurrences Action PRA
- Engineering Guidelines
- Create Internal Standards
- Influence Industry Standards

Ergonomic Guidelines

Engineering specifications to design to –
hose insertion efforts

Process guidelines to adhere to regarding
allocation of work – frequency of electrical
connectors, push pins
Height of work / Overhead work guidelines

Single Point Lesson
Assembly Ergonomics Allocation Guidelines

How to setup jobs to ensure proper ergonomic design?

1. Look at the operation the element is being added to (Review the To-From sheets to determine the elemental moves)
2. Evaluate if adding the element will violate the following Ergonomic Guidelines:
 - Limit the following postures to 50% of work cycle
 - Over head work – defined as working with hands at or above 2215(7'5mm from floor level) and/or above 20'600mm (from work base) for a seated worker
 - Forward bending – trunk angle > 45 degrees (zero degrees is upright)
 - Lateral (side) bending – trunk angle > 20 degrees (zero degrees is upright)
 - Vehicle ingress/egress (sitting/stepping postures) – See SP1, unless Operator Ingress/Egress: Workstation Design Specifications for Work inside vehicles
 - Overhead Work: Deep Dive
 - Although a guideline of 50% of work cycle will provide adequate egress production there are circumstances that a Deep Dive of the overhead work is necessary
 - When an operator holds a part or tool with one hand weighing 5 lbs/kg or greater, an Overhead deep dive is needed.
 - The Overhead Deep Dive analysis requires specialized training
 - Limit hand intensive activities to the following
 - Any combination of Handstart, Handstart and Tighten, Seal, Align, Seal, Press, Insert, Connect – 10 per minute / hand
3. Run the Ergonomic APT ergo tags on the Proposed Allocation Plan.
 - See Figure 1 on Page 2 of this Document
4. When APT ergo tags are Red, this is a **Red** and the elements need to be reviewed for resolution.
 - Note: The LEC should be involved with the allocation process, providing assistance and expertise on ergonomic principles where needed.

Why develop Ergonomic Guidelines?
The ergonomic design, manual handling (lifting, carrying, pulling, etc.), repeated motions of the upper limbs (hand, wrist, elbow, shoulder, neck) and repeated forces (push, pull, twist, etc.) are elements of jobs that in combination need to be considered when evaluating. It is recognized that consideration needs to be given to proper ergonomic design of work needed to be incorporated into any allocation studies. These guidelines were established to ensure the operator's safety when adding elements to an existing process or setting up new operations.

When do we apply the Ergonomic Guidelines?
The ergonomic guidelines are applied whenever there is a rebalance of the plant, or a new operation is being established. The rebalance may result from product revisions, process changes, line speed changes or a new launch.

What happens when one of the Guidelines is violated?
The guidelines provide generic ergonomic parameters within which the IE should allocate work. Adhering to the ergonomic guidelines in the responsibility of the Plant IE, Launch team, POC team, or other group having the change in allocation. Situations are not met, in those situations, rebalancing of the guidelines must be brought to the attention of the local Ergonomics Committee (LEC). A trained member of the LEC will then analyze the job in question using a set of Ergonomic Analysis Tools. If the APT flag is flagged, the job should be reviewed and only the problems are acceptable and the forces are equal or below the ergo spec. If the ergo spec is not known, use Handbook with a 20% female strength to determine the acceptable force. All relevant efforts must be available for the job to be Green. If forces are well below the ergo spec a deviation can be granted based on further study using a deep dive tool. If the frequency is greater based on further study using a deep dive tool. If the frequency is too low to push pins refer to the push Pin Flag card. A higher frequency can be allowed for lower force pins.

Force/Frequency Guideline for Push Pins

Plan, Do, Check:
There are many indicators that will confirm that the allocations are capable and ergonomically acceptable, involve the LEC or the allocation Process. Use the tools such as APT ergo tags and talk to the operator about their concerns.

Process Change# 40414 (banned)
Review Date: Jan-2017 (pending)

Single Point Lesson
Reaches and Bends

Key Elements
The human reach zone is one of the most important components to designing a workstation. Human reach zones provide information as to whether a post is reachable or not, as well as the different discomfort levels experienced within the zones.

Our Goal at Ford is to design jobs that are within the reach capabilities of 95% of our Operator population. (Below is the recommended reach zones that should be given into consideration when designing workstations.)

How long can an operator be in a bent posture?
It depends! The strain on the back is a combination of weight in the hands and how far away from the body it is held! The risk associated with holding a bent posture increases as this posture is held for longer periods of time. The general guideline is that forward and lateral bending should be limited to less than 20% of the total cycle.

Forward bending – trunk angle > 45 degrees (zero degrees is upright)

Lateral (side) bending – trunk angle > 20 degrees (zero degrees is upright)

What should I do if I have an operator who is in a bent posture for 50% of their cycle?
Investigate if there are any opportunities for the operator to support themselves while bending, using their opposite hand to brace themselves and relieve leaning on the vehicle which will support the lower back and reduce the stress on it. If there are no opportunities to reduce the degree and time spent in a bent posture, contact your LEC for a formal ergonomic assessment.

What options do I have for shorter operators who are having difficulty reaching to do their job?
There are various assembly aids available to assist a shorter operator with doing their job in a more comfortable work zone than tools, adjustable skidlets, adjustable platforms, portable platforms, happy seats, ergo dog, support bars and portable seats.

Supervisor survey:

Y / N

- Is all my stock presented to the operators using skidlets, air tables, turn tables, etc. so that reach and bend is minimized?
- Do I have any shorter operators that are having difficulty reaching to do particular elements on their job?
- Can they be provided any assembly aids to improve workload, etc.?
- Are there any operators in a bent posture for greater than 50% of their cycle? (Call IE for assistance)
- Are operators holding a weight greater than 7 lbs in an assumed bent posture? (If yes, contact your LEC for a formal ergonomic assessment.)

STANDARD REPORT

REQUIREMENT

ID: HJ-0003 Ver: 9 Copy: 0 Title: HOSE INSERTION EFFORT

Owner: HJOINT

Priority: Level: SPECIFICATION

Release Date: 09-Feb-2010

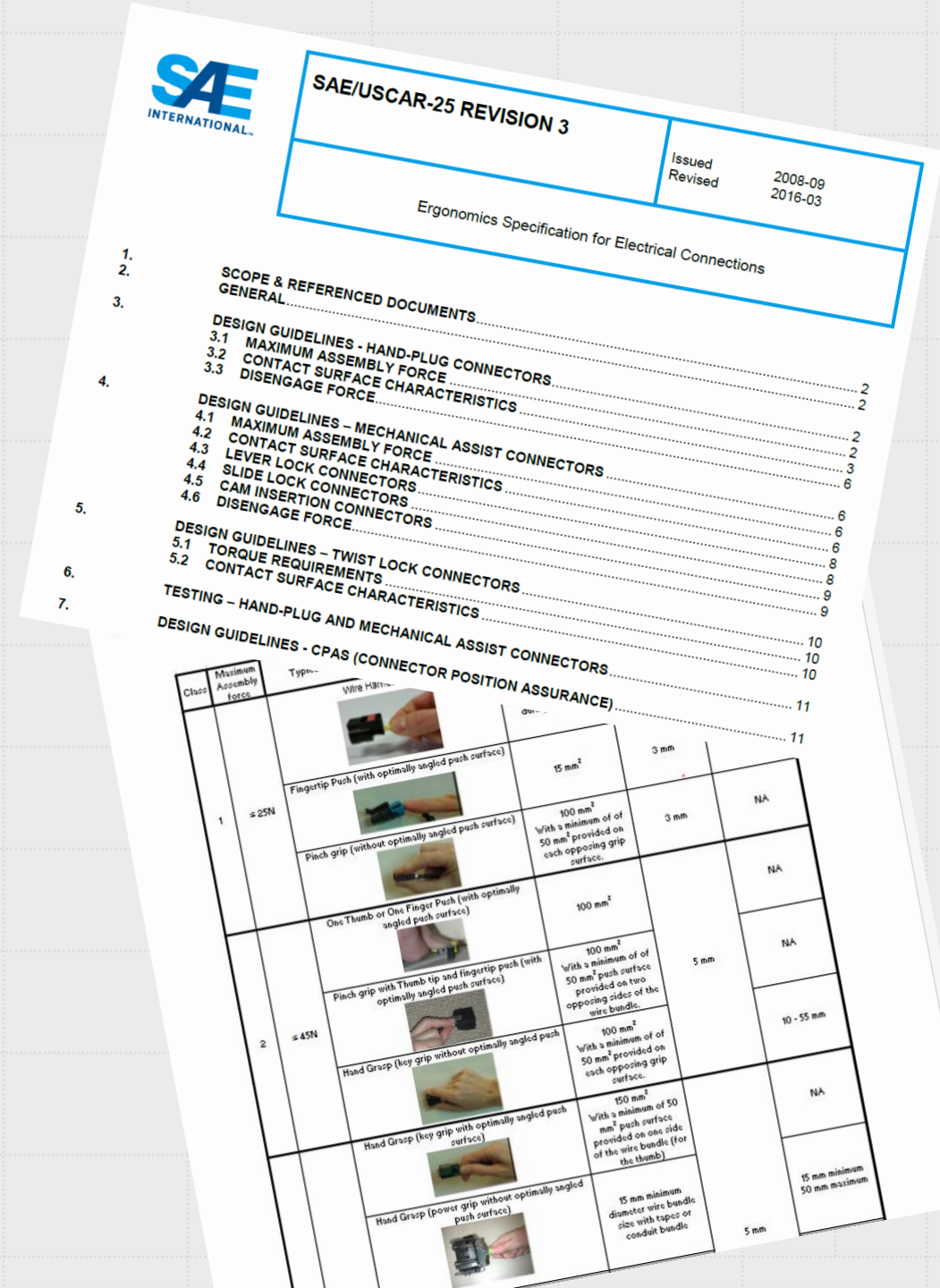
Obsolete Date:

Requirement Description:

Hose insertion force shall comply with associated specification requirements and specific vehicle assembly targets cascaded from Ergo Engineering.

Industry Standards

- Working with USCAR, Ford, GM and Chrysler were able to create a SAE Ergonomic specification for Electrical Connectors.
- Others in your industry probably have the same Ergonomic issues.



Build a Culture of Zero Injury mindset

No more well injuries happen.....

You can't improve what you don't measure

What gets measured gets done

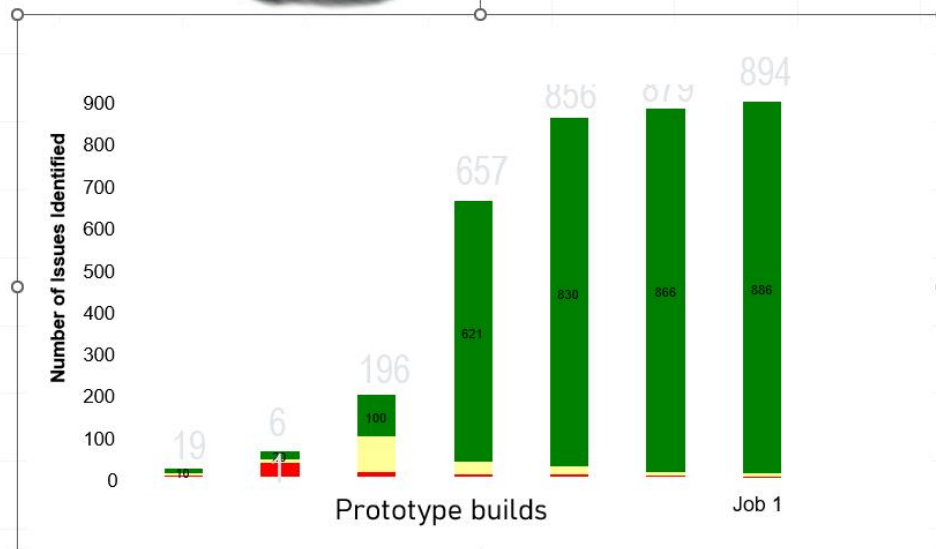
Lagging indicators – injury rates

Ergonomics needs leading indicators created around your companies plan.

Program Metrics : Measured and Reported at Management reviews



Launch with
Zero **Red** jobs

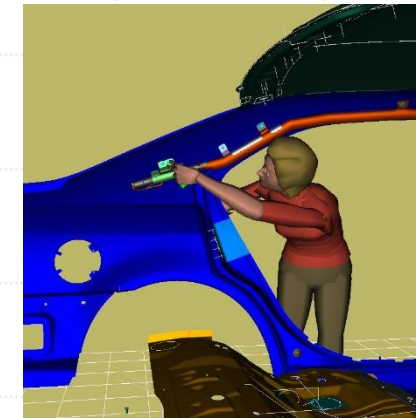
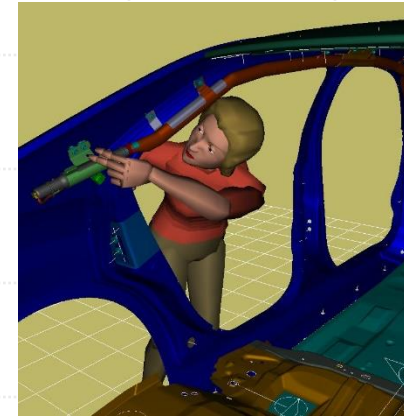
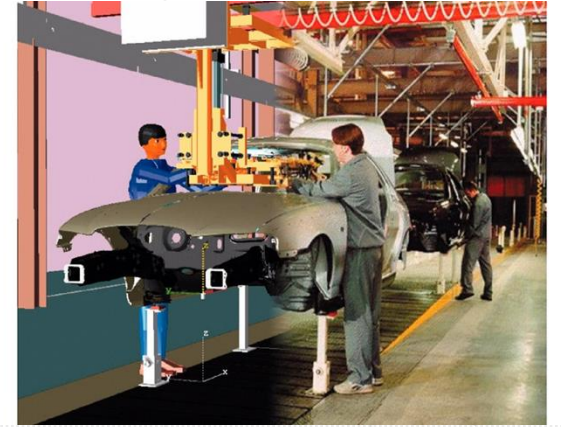


- There will be no **RED** Ergonomic Product Design Issues by Prototype build
- There will be no **RED** Ergonomic tooling and workstations by Job# 1

* On all S4 above programs, new parts

Ergonomics is part of Engineering

Virtual Build

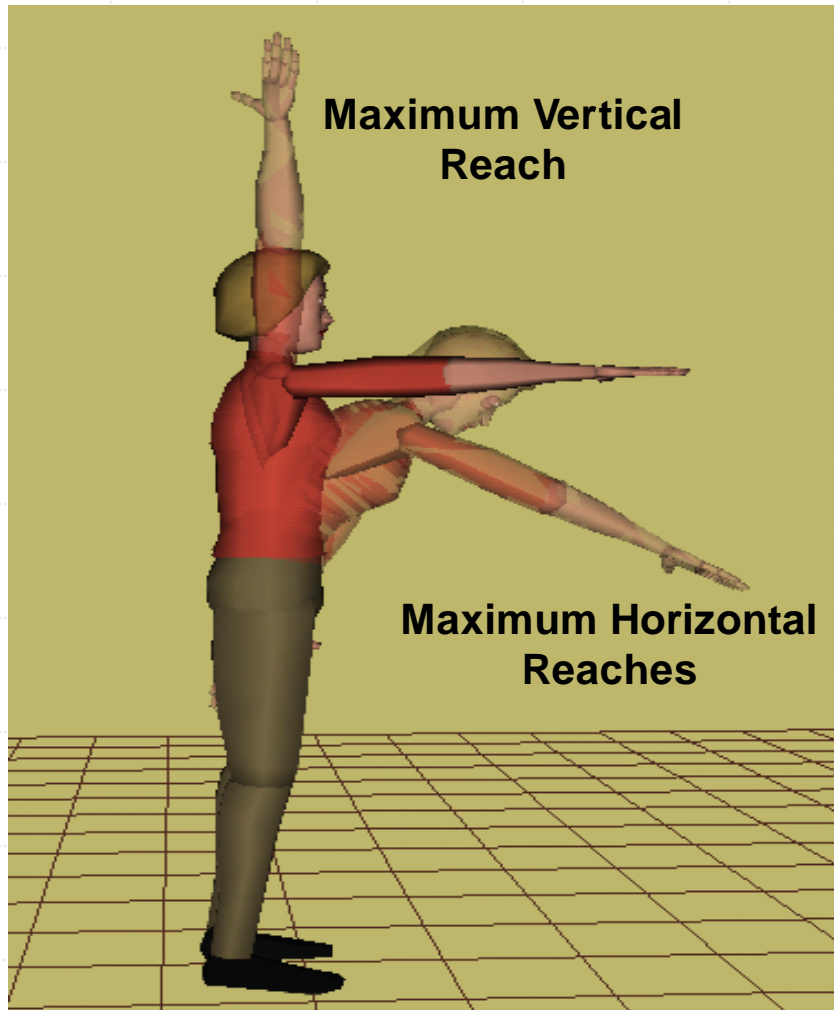


Why fix the ergonomics issue?
To meet engineering standards
To achieve program and individual objective
Cost evaluated like any engineering issue – what's the risk if we don't fix it.

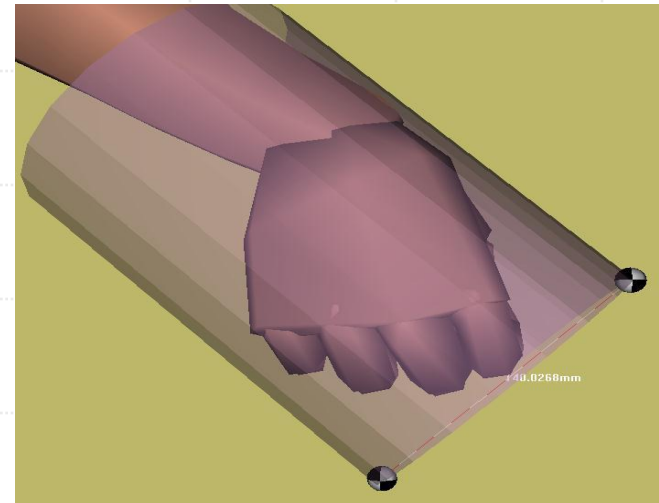
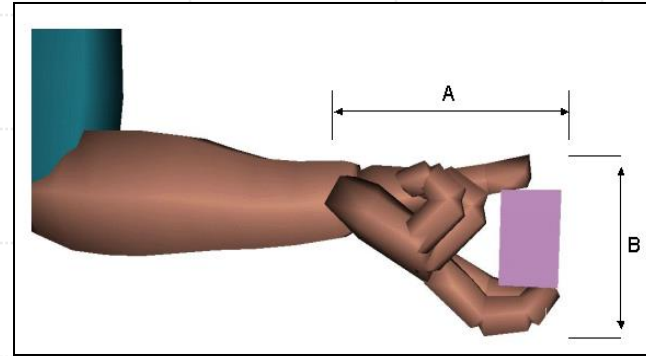


Assembly Ergonomics ARL

Reaches



Clearances



Virtual Build Process Healthchart

StudyManager : Base Release - Latest Version

Virtual Build Process Health Check

Chassis Line2

No.	Name	GSPAS Number	Usage
3	UCA Install	o	
4	HumanOperation2	o	
5	Axle Deck	o	
6	HumanOperation3	o	
7	Str Gear Deck	n	

Axle Deck

Analysis Rating

Overall Status

Assembly Feasibility:

Tooling:

Pfmea:

Safety:

Power tool:

Ergonomics:

Delta Audit:

Process:

Remarks

StudyManager : Base Release - Latest Version

Virtual Build Process Health Check

Chassis Line2

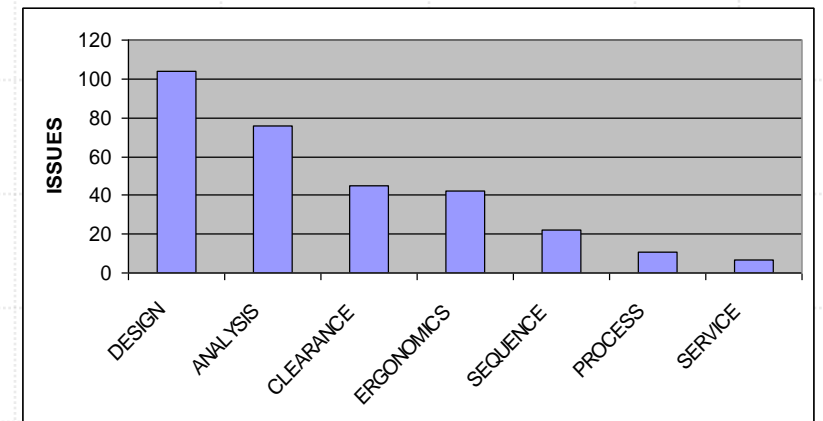
No.	Name	GSPAS Number	Usage
1	Frame Deck	o	
2	HumanOperation1	o	
3	UCA Install	o	
4	HumanOperation2	o	
5	Axle Deck	o	

Axle Deck

Analysis Rating

Criteria:	Problem:	Handled by:	Date:	Issue Ref No
Assembly Feasibility Clearance	Issue with new support bracket Should not be PIA	VDANDAMU	8/09/01	12865
Tooling	Limited Access for powertool	JMCFADD7	8/01/01	32671
Pfmew				
Safety buyoff				
Ergonomics				
Delta Audit				
Process definition				
Power tool access				

- There will be no **RED** Ergonomic Product Design Issues by Prototype build



Best Practice : Global Standard Cells

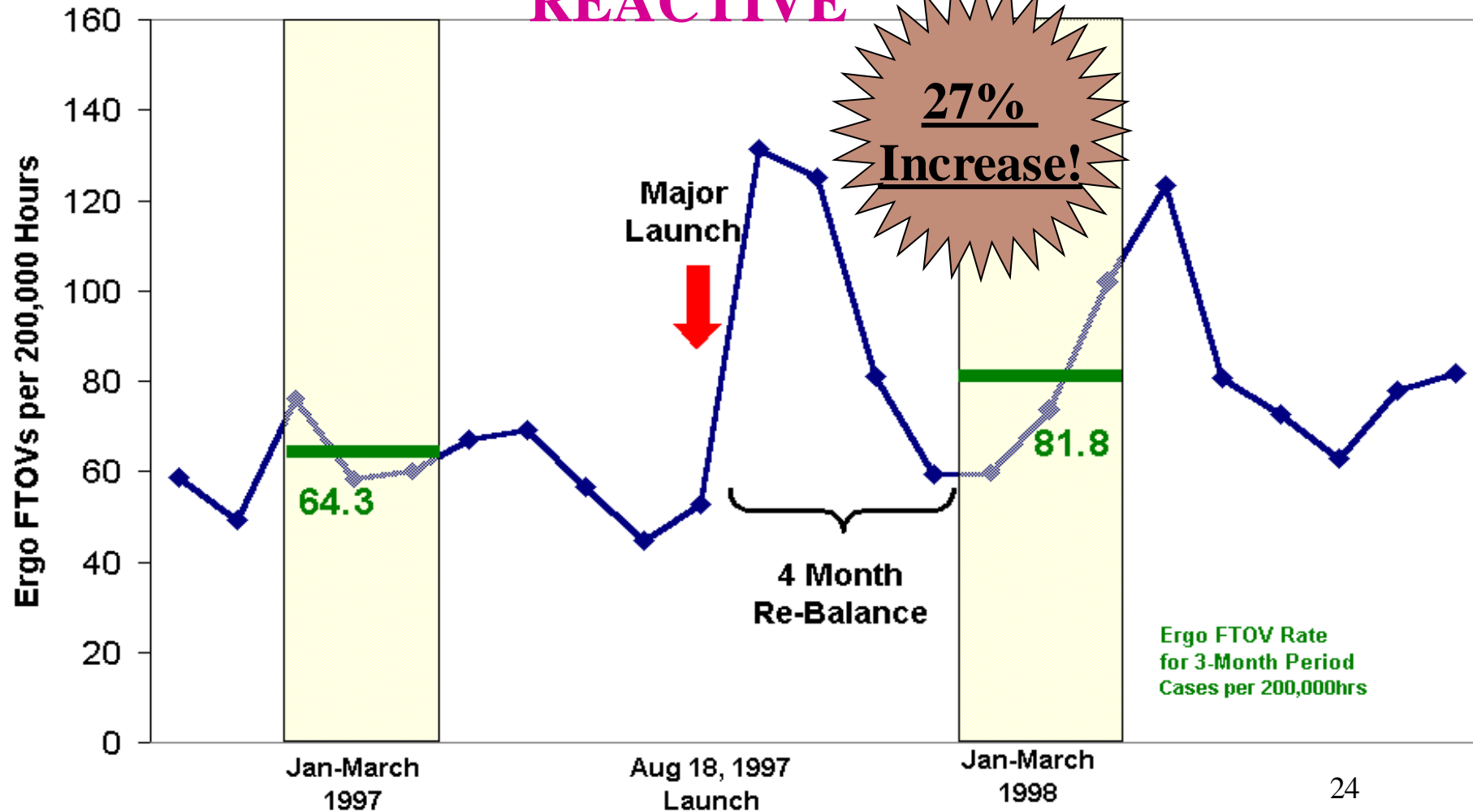


Prevent Reoccurrence

Ergo FTOV Rate for 3-Months After Re-Balance Compared to Prior Year

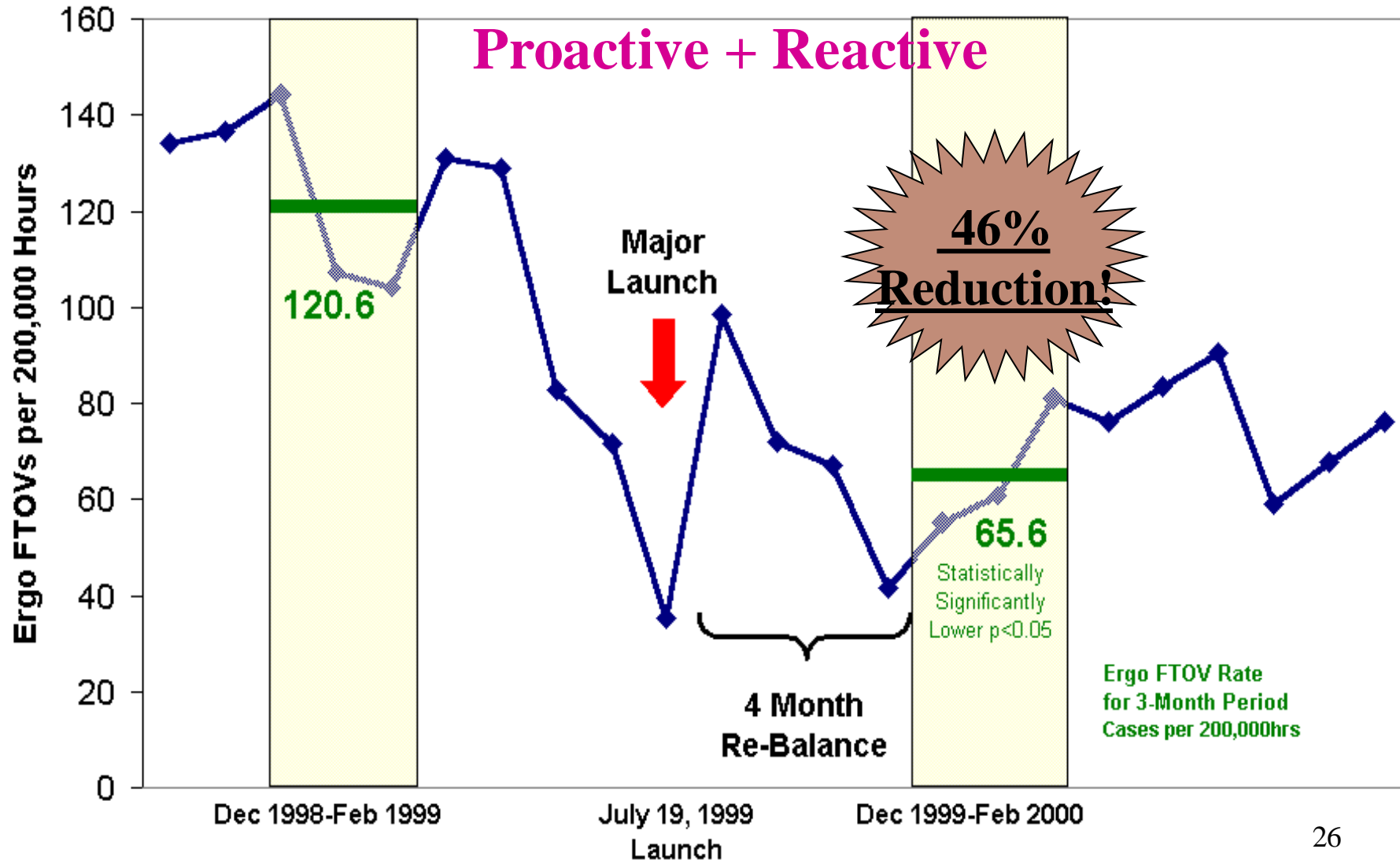
Edison Assembly: Trim & Chassis only

REACTIVE



Ergo FTOV Rate for 3-Months After Re-Balance Compared to Prior Year

Wayne Assembly: Trim & Chassis only



Continue to reinforce the value of Ergonomics

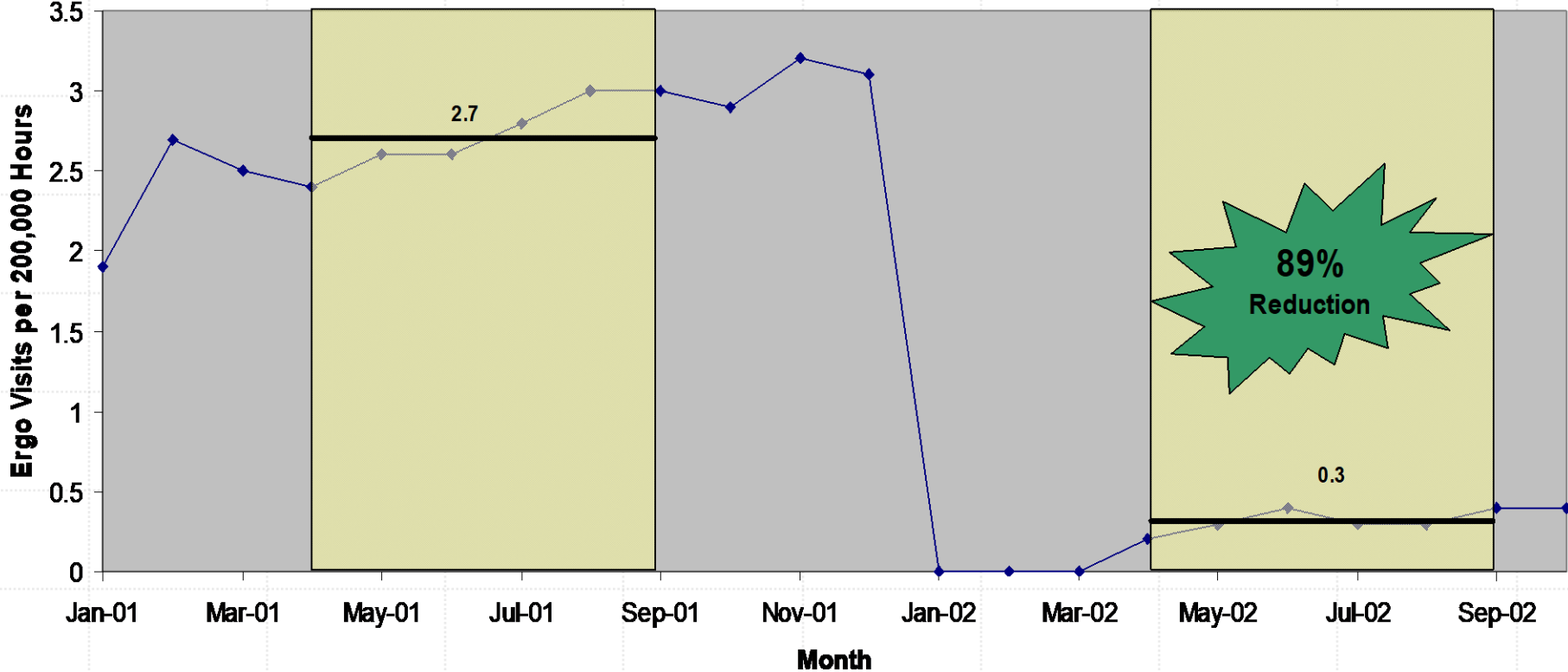
The Economics of Ergonomics



Lagging indicator – verifies the process

Pre and Post Launch with Virtual ergonomic assessments

Ergonomic Lost Time Case Rate



Zero Injury Mindset

Parts can be assembled by the operator 100% of the time in a manner that delivers quality (zero defects, zero recalls), at cycle time, with no injuries to the operator, every job, every day, for the life of the vehicle.” Marcy Fisher, Chief Engineer – FAE

- System Design specifications include assembly ergonomic limits
- An ergonomic issue is an Engineering issue
- An ergonomic RED is definable and defensible!

