CUSTOMIZED SOLUTIONS FOR FACTORY ASSEMBLY
PRODUCTIVITY ISSUES

Excerpts from our new book
“CLASSIC PRODUCTIVITY SYSTEMS for the assembly manufacturer or distribution center”

July 1, 2012

www.jdgray-associates.com
There have been four recently developed inexpensive and customized solutions for factory assembly productivity issues.

- **QUIZ** - A Factory Assembly Productivity Evaluation
- **DIAL** - Budget Costing and Investment Return Dial for Assembly and Storage Conveyors
- **BOOK** - CLASSIC PRODUCTIVITY SYSTEMS for the assembly manufacturer. Includes QUIZ. Select book version - Rev A includes our generic industrial engineering proposals or Rev B that does not.
- **ARTICLES** – Factory Assembly Productivity:
  - Assembly Automation Vs Outsourcing
  - Work Measurement
  - Pick And Pack Options
  - Factory Paced Assembly…Short Run Scheduling And Conveyor Configurations

From a classical industrial engineering point of view, how efficient is the manufacturer’s factory assembly operation? Take the quiz and see! The quiz will grade the company performance in areas of: Space utilization in terms of stockroom or warehouse storage, work-in-process storage, finished goods storage & work-in-process thru put; Direct labor controls regarding standards, labor reporting, short-interval-systems & industrial incentives; Assembly system automation level; Work station layout basis; Stockroom/warehouse materials handling mechanization level; Work-in-process materials handling, tracking and inventory system mechanization level.

**SCORE**

<table>
<thead>
<tr>
<th>SPACE UTILIZATION: WORK-IN-PROCESS THRUPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Score 1: Hand Carry</td>
</tr>
<tr>
<td>Score 2: Palletized using Fork Truck</td>
</tr>
<tr>
<td>Score 3: Palletized using Conveyor</td>
</tr>
<tr>
<td>Score 4: Tote Tray using Conveyor</td>
</tr>
<tr>
<td>Score 5: Tote Tray using Transporter</td>
</tr>
</tbody>
</table>

Here’s a chance to really know the operating efficiency of your factory assembly operation!

[www.jdgray-associates.com](http://www.jdgray-associates.com)
In the age of computers and high technology there is no device available that does what the investment return dial can do.

It took the factory manufacturing productivity firm of JD Gray associates over ten years to compile reliable return on investment data for transporters, progressive assembly carousels, live storage and retrieval carousels, rotary indexing assembly tables and conveyorized work centers.

The investment return side of the dial plots a dollar return ratio within the savings areas of direct labor, materials handling, order picking, carrying charges on inventory, carrying charges on work-in-process, space and a grand total return. By rotating the dial to the savings area and then to the conveyor type, return on investment ratios will appear for the first, fifth and tenth year. By multiplying budget cost of the conveyor by the investment return ratio, the total savings will be ascertained.

To determine the budget cost turn the dial over and rotate to the conveyor type needed. Align the arrows to the station/bin subsection and pull the slide so the top opening is over the number of assembly stations or storage bins required. The bottom opening of the slide will then reveal budget cost for that specific item. Transporters, progressive and storage carousels have prices ranging from ten stations to eighty stations in increments of two; rotary tables and conveyorized work centers range from three stations to twenty stations in increments of one.

The dial will benefit the equipment salesman in that he will be able to calculate cost and investment return while making his presentation to the prospective buyer.

The dial should become a necessity for the industrial engineer, project leader and product line manager to determine the potential savings impact of a conveyor productivity improvement program, accurately, before detailed feasibility analyzes are made.

www.jdgray-associates.com
CLASSIC PRODUCTIVITY SYSTEMS
FOR THE ASSEMBLY MANUFACTURER
OR DISTRIBUTION CENTER

HOW EFFICIENT IS YOUR OPERATION? ...TAKE OUR QUIZ AND SEE!

CLASSIC PRODUCTIVITY SYSTEMS IS A COLLECTION OF LABOR AND SPACE
OPTIMIZATION TECHNIQUES, ASSEMBLY CONVEYOR TYPES, CASE HISTORIES,
MATERIALS HANDLING SIZING DIALS AND EXAMPLES OF VARIOUS RETURN-ON-INVESTMENT SCENARIOS DESIGNED TO ASSIST THE INDUSTRIAL SECTOR BE COST
COMPETITIVE.

REV A: CONTAINS OUR GENERIC INDUSTRIAL ENGINEERING
PROPOSALS SHOULD YOUR COMPANY SEEK OUTSIDE EXPERTISE IN YOUR IMPROVEMENT EFFORT.

JD GRAY ASSOCIATES

www.jdgray-associates.com
There are two versions of the book: Rev A (316 pages) will contain JD Gray Associates’ generic industrial engineering proposals should your company seek outside expertise in your cost reduction endeavors. Rev B (279 pages) will not.

Contains the aforementioned QUIZ. The QUIZ determines the efficiency of a factory assembly operation based on installed direct labor control systems, level of robotics, layout methodology, degree of inventory / tracking software and materials handling mechanization.

In “CLASSIC PRODUCTIVITY SYSTEMS” JD Gray Associates has developed and outlined a two phased approach designed especially for each clients requirements:

1. OPERATIONS AUDIT. Our industrial engineering critique of plant-wide operations determines a cost reduction master plan.

Our Operations Audit will develop materials handling configurations, work cell automation types and classical direct labor controls systems that are best used with assembly manufacturers or distribution centers. It is the first and most critical step in cost reduction as it is performed prior to materials handling or automation equipment purchase to enable the client to view mechanization alternatives with paybacks for each scenario. This is an industrial engineering critique of plant-wide operations and includes thru put analysis, staffing, plant wide-departmental-work station layout, equipment specifications-request for quotations-quotations, semi-automation tooling, detailed productivity recommendations, alternative material handling systems, outline of consulting services, comparison of savings versus cost & phased modular segments of our recommended systems.

As a result of the completion of our Operations Audit…concentrated effort will have been paid to the classical productivity areas of materials handling, work-in-process storage and tracking, semi-automatic machinery, paced assembly, short-interval-scheduling, labor reporting, industrial engineered standards and methods & industrial incentives…and sub proposals will be generated where the return-on-investment is greatest.

We have provided samples of the major Operations Audit sections including the personnel summary, the implementation ‘action required’ section, layout, the savings and cost section and the executive summary as well as step by step preparation procedures so you can create your own Operations Audit if you so choose. We have also provided the final documents of some of our installed consulting activities including a workstation visual aid, workstation line balancing, final materials handling equipment specifications, a sample of the control panel preset dwell time by model, implementation follow-up, final component automation equipment specifications, short run scheduling and a paced assembly manufacturing procedure. JD Gray Associates’ materials handling live storage and retrieval carousel and transporter sizing dial fliers and our Grasp conveyor system configuration fliers have been supplied. Case Studies have also been provided where a few of our Classic Productivity Systems have been installed.

2. IMPLEMENTATION. All required industrial, mechanical and electrical engineering services to ensure the proper functioning of purchased hardware. These activities are always outlined and costed in the Operations Audit generated report but can be performed exclusive of same if desired.
From management’s perspective our new book [CLASSIC PRODUCTIVITY SYSTEMS for the assembly manufacturer] can serve as a:

<table>
<thead>
<tr>
<th>Training Tool for the Industrial Engineer</th>
<th>Training Tool for the Production Supervisor</th>
<th>And to supplement the Training Tools there are:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifies and illustrates the major components of a Return-On-Investment (ROI) improvement analysis including samples of:</td>
<td>Lists and develops savings while showing graphics for labor and space savings techniques and materials handling equipment on:</td>
<td></td>
</tr>
<tr>
<td>A Personnel Summary</td>
<td>IE Standards and Methods</td>
<td>Case Histories</td>
</tr>
<tr>
<td>Implementation Actions</td>
<td>Short-Interval-Scheduling (S-I-S)</td>
<td>Productivity Evaluations - How efficient is your assembly operation? Take our QUIZ and see!</td>
</tr>
<tr>
<td>State-Of-The-Art Layout</td>
<td>Paced Assembly Lines w/wo Robotics</td>
<td>Ergonomic Examples</td>
</tr>
<tr>
<td>Savings and Cost Summary Sheets</td>
<td>Industrial Incentives</td>
<td>Paced Assembly Line illustrations of instruction sheets, visual aids, line balancing, work cell automation, short-run scheduling and manufacturing procedures</td>
</tr>
<tr>
<td>Executive Summary with ROI by Phase</td>
<td>Pick and Pack Systems</td>
<td>Examples of Staffing and Organization Charts</td>
</tr>
<tr>
<td>The Preparation of an ROI analysis</td>
<td>Stockroom, Finished Goods &amp; Work-In-Process</td>
<td>Sample Procedures for S-I-S, Labor Reporting, W-I-P Storage and Tracking, Materials Handling Equipment Synchronization, Dispatcher and Flow Rack Tote Tray Assignment for a Dual Level Transporter</td>
</tr>
<tr>
<td>Improvement generated from the ROI analysis.</td>
<td>Use of Temporary Industrial Staffing Companies to reduce in-house IE cost.</td>
<td>Departmental Materials Handling Configurations and Budget Cost.</td>
</tr>
</tbody>
</table>

Every factory assembly library should have a copy as a cost reduction guide for their production supervision and industrial engineers.

[www.jdgray-associates.com](http://www.jdgray-associates.com)
FACTORY ASSEMBLY PRODUCTIVITY ARTICLES:

ASSEMBLY AUTOMATION VS. OUTSOURCING INCLUDES:

- Immediate Job Creation Steps
- Rising Offshore Productivity and Assembly Cost
- Conveyor Equipment
- Robotic Equipment
- Semi-Automation Savings Milestones
- Stimulus Funding Project Milestone Chart

EXCERPT

…. The assembly of components making model trains is a very labor-intensive operation and remains one of the most frequent jobs outsourced.

Even though overseas labor and transportation cost are rising, it is impossible for USA assembly manufacturers to be cost competitive with countries that violate human rights unless they semi-automate!

For every 200,000 outsourced manufacturing jobs to countries such as China & Mexico …the USA can get back 70,000 of these jobs…at the same output rate of the 200,000 jobs…for a cost of $5.38b in automation equipment and industrial engineering services! There are 6.0m long term unemployed in the USA…3.7m of these jobs have been outsourced to China and Mexico.

How many factory jobs were lost to China or Mexico in your country….?

WORK MEASUREMENT PCB INCLUDES:

- Types of WORK MEASUREMENT for factory assembly applications
- Methodology of a properly developed industrial engineered standard for a repeatable and non-repeatable work task
- A description of each productivity improvement
- A chart listing each productivity improvement with savings potential
- A detailed savings description and illustration for a semi-automated linear or rotary, precision indexing paced assembly and packaging line…and a transporter…and a live storage and retrieval carousel

www.jdgray-associates.com
….So where to start? All of the direct labor controls JD Gray Associates’ installs are dependent on accurate standards and methods. If it takes accurate standards to establish accurate standard data then accurate standards in fabrication, sub assembly and final assembly is where initial concentration should take place. We can tell you that the use of historical hours to predict the labor content, staffing, scheduling and costing of fabrication, sub assembly and final assembly is at a minimum 15% loose, so that is the conservative potential labor gain.

WORK MEASUREMENT TYPES – Assembly manufacturers or distribution centers have three main types of labor standards: Output Estimates that a department foreman generally establishes. Historical output that are records of past accomplishment. And Industrial Engineered Standards that are developed by trained and experienced technicians or engineers. The primary advantage of estimates and historical output is there is no cost involved in the process of development but the main disadvantage is they are not accurate and almost always are 15% below that of the industrial engineered standard.

METHODOLOGY OF A PROPERLY DEVELOPED INDUSTRIAL ENGINEERED STANDARD – REPEATABLE WORK TASKS - The following steps provide valuable information that can be used to improve any repeatable assembly operation or a distribution center work tasks such as order picking:

Define Objective. What is your primary goal? Is it cost reduction, accurate labor reporting, operator performance records, product labor pricing or line (time) balancing of work? Determining your objective will assist in developing a time frame to accomplish your goal.

Work Method Optimization. Reduce to writing the detail of each alternative method. Use power tools or fixtures where applicable. Maximize hand and eye coordination and reach ergonomics. Take a cycle time of each alternative method before developing a detailed time study to ascertain which method takes the least overall time. This generally will give you an idea of where to concentrate your efforts.

Detailed Work Measurement. The development of a labor cost expectation or industrial engineered standard and method includes....

PICK AND PACK OPTIONS INCLUDES:

- Budget costing, ROI and illustrations on three alternative packing methods
- Paced Packaging concept using manual flow racks for two hour queue
- Semi-Automation concept using live storage and retrieval carousels (LSRS) for two hour queue
- Automation concept using live storage and retrieval carousels for two hour queue and insert/extract robots

www.jdgray-associates.com
The packaging function should not be performed at the thermoforming machines but in a remote area. Since machine cells are assigned both bulk and combo orders, all products from all machines should be affected by the recommended system. The **CLASSIC PRODUCTIVITY SYSTEM** for stacks of formed and trimmed containers coming directly from a thermoforming machine cell would be to inspect, sort and place the stacks in a tote tray with lids then move to a remote area for temporary staging that will directly feed a paced packaging system using optional work-in-process buffers with or without robotics. By doing this, there will be no time imbalance between the packer and the machine cycle causing lost hours and incomplete/damaged stacks, no operator downtime waiting for a new mold changeover to take place, and no loading of full cartons for combo orders to reduce warehouse space causing customers to occasionally receive bulk cartons instead of combo cartons as all in-process half containers will be in tote trays....

[Diagram of packaging system with labels: PICK & PACK TOP & BOTTOM, CARTONS, BOTTOMS, TOPS, FLOW RACK, LSRS, SEAL GLUE/ TAPE CARTON TOP, FIXTURIZED UPRIGHT CARTONS (LINEAR), SYNCHRONOUS PRECISION INDEXING CONVEYOR]

www.jdgray-associates.com
FACTORY PANCED ASSEMBLY...SHORT RUN SCHEDULING
AND CONVEYOR CONFIGURATIONS INCLUDES:

- Paced Assembly Procedure
  - Prototype
  - Changeover
  - Learning Cycle
  - Production Run
  - Job Ticket
- Proper Scheduling by Work Station and Dwell Time
- Economics of Proper Scheduling
- Illustrations of Proper Scheduling
- Conveyor Configurations
  - Linear Slider Bed
  - Linear Pallet
  - Overhead Monorail
  - Heavy Duty Rotary
  - Square Rotary Pallet
  - Rectangular Rotary Pallet
- Progressive
- Work Center System
- Deluxe with all Standard Options

EXCERPT

.... If all candidates for scheduling had an identical number of work stations, a potential problem
would not exist. But since good conveyor balancing lends itself toward a varied number of
workstations it does not occur and must be treated accordingly. Assemblies should be
sequenced by the least difference in workstation number. The last part number scheduled
should be the extreme for the period (i.e. most or least stations).

If all candidates for scheduling had an identical dwell time, lost hours would be maintained at a
minimum. But conveyor schedule balancing again attempting to achieve an ideal workload will
make this item vary and must be scrutinized carefully. Assemblies should be sequenced by the
least difference in dwell time.

Ideally then, the correct method to employ when attempting to sequence assemblies for a short
run assembly conveyor is to collect all workable jobs, list them separately and sequentially by
work station and dwell time, select and schedule reflecting nearest proximity to both in ascend-
ing or descending order dependent on last job run on current schedule. Consider workstations
of primary importance....

www.jdgray-associates.com