

**JD GRAY ASSOCIATES  
INDUSTRIAL ENGINEERING CONSULTANTS**

**PILOT RUN  
SEMI-AUTOMATIC  
PALLET PICKING SYSTEM  
WITH OR WITHOUT  
INSERT/EXTRACT ROBOTICS**

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**WHY TAKE THIS FIRST STEP?**

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## **Horizontal Pallet Carousel Systems Improve Order Building Productivity And Accuracy In Industrial Equipment Operations**

REMSTAR Press release date: November 12, 2001

Horizontal pallet carousel systems (with or without robotic insert and extraction) are an efficient and cost effective alternative to palletizers and gantry robots in operations requiring mixed pallet and split layer order building. These systems allow businesses to step up from manual operations to increase productivity and throughput. In industrial applications, horizontal pallet carousel systems can significantly reduce order picking errors, and improve operator productivity and system throughput by as much as 300 to 400 percent.

Horizontal pallet carousels are units of horizontally rotating shelves that move automatically in response to operator commands. Each carousel has a range of 12 to 100 pallet positions and can accommodate up to 3,000 pounds per position, double-pallet high. They can store more items and more weight than conventional shelving while using up to 60 percent less floor space and 80 percent less cubic space. In a pallet carousel system, several horizontal pallet carousels are stocked with pick items and one or more horizontal pallet carousels serve as put stations where the mixed pallets are built. The operator work zone is located between the pick and put units. A pick-light system shows which carousel and shelf to pick from and how many pallets to pick. In a typical industrial system application, a wave of orders is downloaded to the picking workstation.

The pick carousels automatically position for the first item selection. An adjacent pick light tower tells the operator the quantity. The operator disperses items in the quantity directed by the sort bar light on the correct pallets on the put carousel. The operator hits a task complete button, moves to the next waiting pick light and repeats the process. Both pick and put carousels automatically position themselves as soon as the operator hits the task complete button for the next pick, virtually eliminating operator idle time. Completed pallets are removed from the put pallet by a lift truck and routed to shipping or consolidation.

Replenishment of the pick carousels can be done between waves, off-shifts, pre-determined times or between picks, depending upon order velocity.

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**Pallet Horizontal Carousels - Material Handling**

White's pallet carousel operates on the same principle as their bottom drive carousel. Instead of bins, the pallet carousel has steel carrier platforms that ride on a flat track using heavy-duty casters. The carousel can handle up to 3,000 pounds per carrier. When coupled to a gantry robot, the system is capable of mixed pallet layer picking.



**Benefits**

- Pallet carousels handle pallets for building mixed loads, picking, and buffering.

They can handle 3,000 pound pallets per position while eliminating wide aisles and retaining fork truck accessibility.

- Automation concept using live storage and retrieval carousels for two hour queue and insert/extract robots
- Maximizes throughput – no walking, searching or lifting
- Maximizes square & cubic foot utilization as well as storage density using double and triple deck carousel stacking
- Insertion/extraction robot can pick from multiple carousels
- Centralized distribution of parts
- Eliminates need for material handling indirect labor operators



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# WITHOUT INSERT/EXTRACT ROBOTICS

## A RETURN-ON-INVESTMENT OF

**16.3 MONTHS**

**9.7 MONTHS**

	SINGLE PALLET PICKING CELL			DOUBLE PALLET PICKING CELL		
ITEM	DESC	COST	SAVINGS	DESC	COST	SAVINGS
OPERATORS	2 (1 PALLET PICK + 1 PUT-A-WAY)			4 (2 PALLET PICK + 2 PUT-A-WAY)		
PALLET SHIFT OUTPUT	935	N/A	\$360,000	1870	N/A	\$720,000
EQUIPMENT BUDGET COST	TWO 28 PLATFORM UNITS With Live Roller and Software	\$469,000 (INCLUDES FREIGHT AND INSTALLATION)	N/A	FOUR 14 PLATFORM UNITS With Live Roller and Software	\$564,000 (INCLUDES FREIGHT AND INSTALLATION)	N/A
CONSULTING FEE	IE SERVICES	\$20,000	N/A	IE SERVICES	\$20,000	N/A
TOTAL		\$489,000	\$360,000		\$584,000	\$720,000

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# WITH INSERT/EXTRACT ROBOTICS

## A RETURN-ON-INVESTMENT OF

**17.2 MONTHS**

**10.2 MONTHS**

	<b>SINGLE PALLET PICKING CELL</b>			<b>DOUBLE PALLET PICKING CELL</b>		
<b>ITEM</b>	<b>DESC</b>	<b>COST</b>	<b>SAVINGS</b>	<b>DESC</b>	<b>COST</b>	<b>SAVINGS</b>
OPERATORS	0			0		
PALLET SHIFT OUTPUT	935	N/A	\$440,000	1870	N/A	\$880,000
EQUIPMENT BUDGET COST	TWO 28 PLATFORM UNITS With Live Roller and Software	\$629,000 (INCLUDES FREIGHT AND INSTALLATION)	N/A	FOUR 14 PLATFORM UNITS With Live Roller and Software	\$724,000 (INCLUDES FREIGHT AND INSTALLATION)	N/A
CONSULTING FEE	IE SERVICES	\$20,000	N/A	IE SERVICES	\$20,000	N/A
TOTAL		\$649,000	\$440,000		\$744,000	\$880,000

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**B. CONFIGURATIONS**



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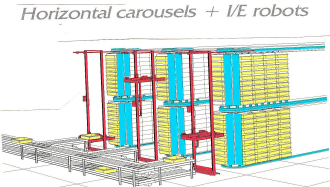
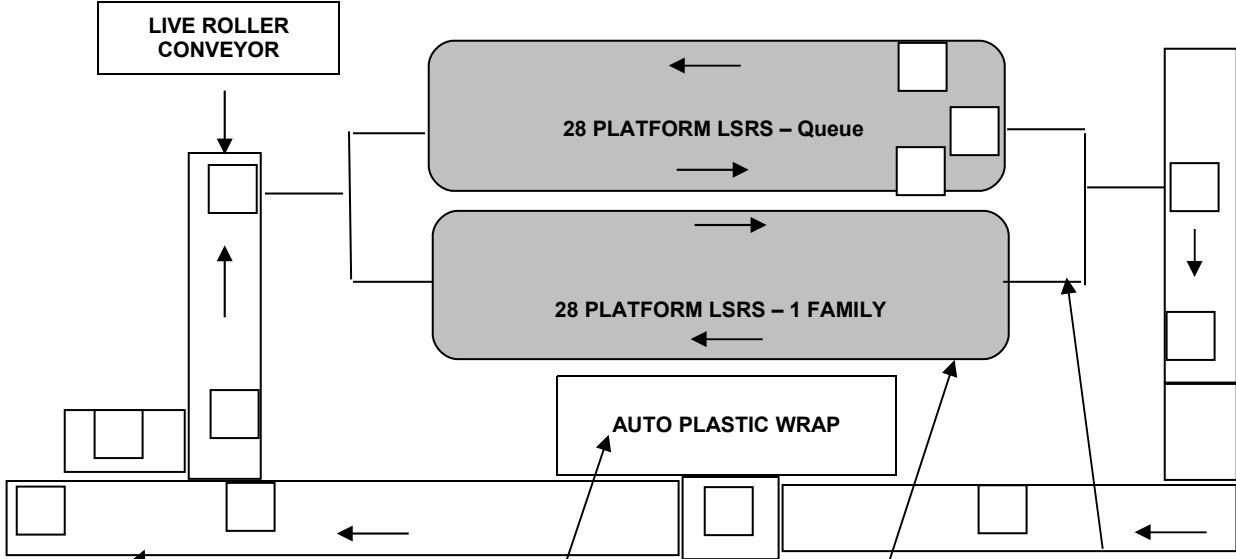
**GENERAL SPECIFICATION**

**PILOT RUN**

**SEMI-AUTOMATIC PALLET PICKING SYSTEM**

**SINGLE PALLET PICKING CELL – EQUIPMENT USING ROBOTIC I/E**

**28 TOTAL PLATFORMS X 3 PALLET RACK LEVELS = 84 PALLETS X 2.5 PALLET TURNS = (up to) 200 PALLETS (SKU'S) PER FAMILY -  
40 MIN RUN OF POTENTIAL OF 1870 AVE PICKED PALLETS IN 7.5 WORK HOURS  
REQUIRES PUT-A-WAY DURING PICK CYCLE ON ALTERNATE LSRS**



*Horizontal carousels + I/E robots*

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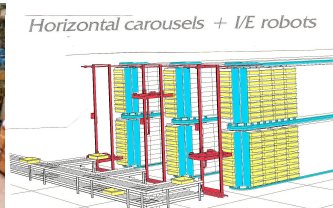
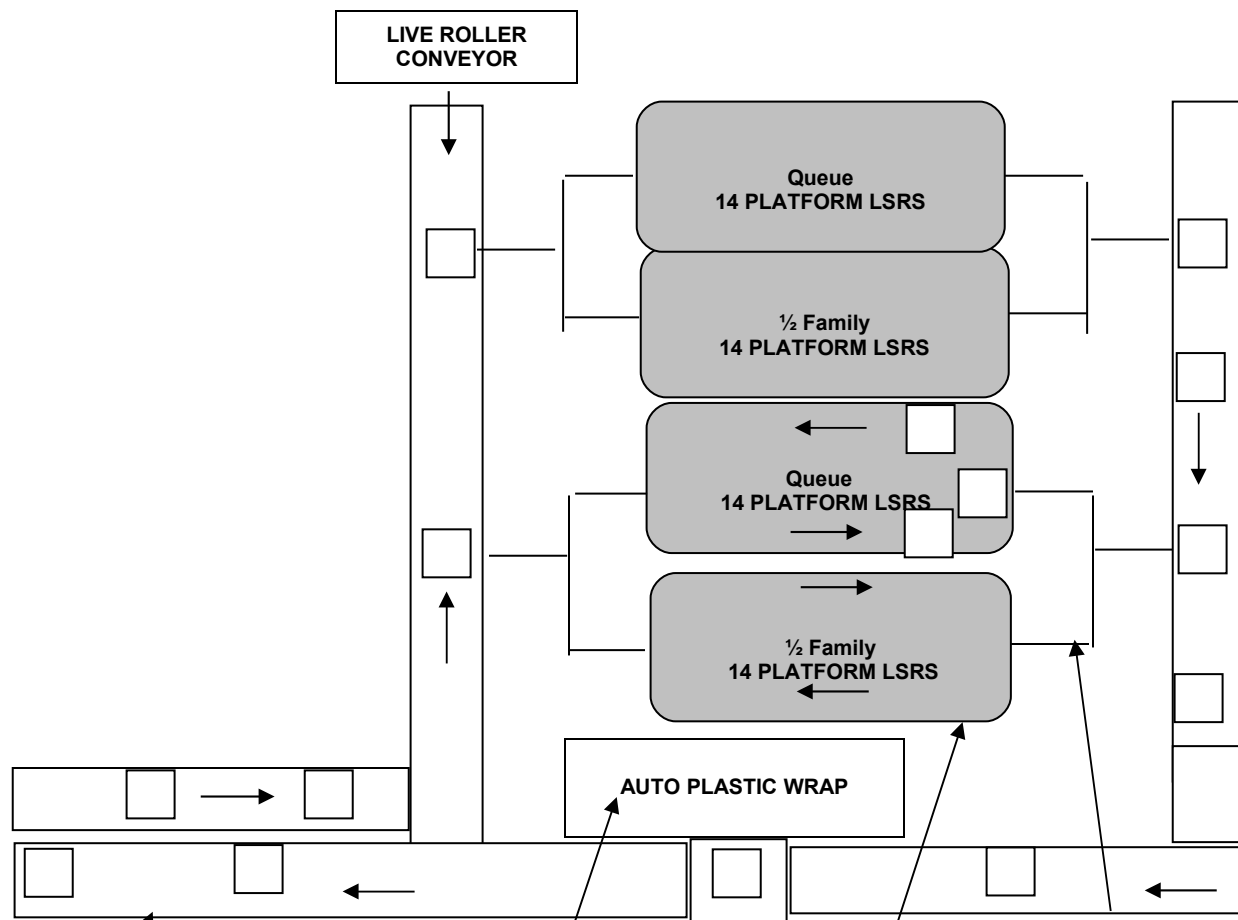
**GENERAL SPECIFICATION**

**PILOT RUN**

**SEMI-AUTOMATIC PALLET PICKING SYSTEM**

**DOUBLE PALLET PICKING CELL – EQUIPMENT USING ROBOTIC I/E**

**28 TOTAL PLATFORMS X 3 PALLET RACK LEVELS = 84 PALLETS X 2.5 PALLET TURNOVERS = (up to) 200 PALLETS (SKU'S) PER FAMILY -  
40 MIN RUN OF POTENTIAL OF 1870 AVE PICKED PALLETS IN 7.5 WORK HOURS  
REQUIRES PUT-A-WAY DURING PICK CYCLE ON ALTERNATE LSRS**



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**C. SAVINGS**

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**PACED FULL PALLET PICKING CAROUSEL SYSTEM  
WITH  
PALLET PLASTIC WRAP MACHINE  
USING OUR  
ATTENDANT INDUSTRIAL ENGINEERING SERVICES**

Will customize (time study, line balance, develop work station instructions/layout/visual aids/case shelf assignment, training, implementation) your full pallet put-a-way and picking to a semi-automated technique. JD Gray Associates utilized one family to prepare and cost our industrial engineering service proposal.

Our proposed semi-automated pallet put-a-way and picking paced conveyor...will incorporate the labor savings or output gain of our standards and methods program, our paced system and our semi-automated cells program.

Typical operation of a Paced Full Pallet Picking Carousel System – A first shift truck unload operator removes sku pallet load, inputs the sku's and it's respective quantity into the lightree software system then places the pallet onto the inbound roller conveyor of the carousel. A first shift pallet put-a-way robot inserts the individual pallet in the carousel location specified by the pallet weight type then inputs to the lightree software system the bin and rack level location of the pallet. The carousel software system recognizes the next pallet order to be picked and moves the carousel holding the correct platform of the first pallet to be picked to the front of the line then illuminates the pallet rack level holding that correct pallet. A first shift robot extracts the illuminated first pallet and places in on the live roller conveyor. While that activity is happening the carousel software system moves the second carousel holding the correct platform of the second pallet to be picked to the front of the line then illuminates the pallet rack level holding that correct pallet. The first shift robot extracts the illuminated second pallet and places it on the live roller conveyor and the process continues. The pallet is then moved by live roller conveyor to the automatic plastic wrap cell where the entire pallet load is wrapped with plastic by an overhead-wrapping robot. The put-a-way and picking operation are on the same shift and would run concurrently meaning in the pod where put-a way is taking place on carousel A...the picking operation is taking place on carousel B. An alternative to this procedure is that insert/extract robots are replaced by operators.

The wrapping time and pallet picking time have been line balanced. The supervisor plots setting on variable dwell timer for the length of time the pallet is to remain in a stationery position before indexing to the next station...this is the station control time we would develop during the line balancing segment of our proposal. The stationery time set on the variable dwell timer will create a pace for the pallet extract operator to finish his respective work task before a chime goes off indicating the dwell time has been depleted and signaling the next automatic index to the automatic plastic wrap cell...or create minimum downtime between robotic extractions and the wrapping operation if robots are used.

As the requirements for pallets output changes so will the timing of the pallet put-a-way and picking operations as well as the number of rack levels number of robots used or operators ...that could mean two robots (operators) instead of one with different picking assignments or in the case of the double case picking cell as many as four picking robots (operators) to increase the pallet output with up to four multi-shift case put-a-way operators. We will develop a work task instruction sheets and visual aids to assist in the training of new operators and temporary replacement of existing operators for each pallet requirement contingency. We will also developed pallet output with required robots (operators) for pallet insertion and extraction and number of pallet rack levels This "pilot" proposal develops a return-on-investment for a single pallet picking cell and a double pallet picking cell with or without pallet insert/extract robotics

The "pilot " is the first step towards pallet warehouse automation.

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THE LSRS (LIVE STORAGE AND RETRIEVAL SYSTEM)  
HAS THE FOLLOWING ADVANTAGES:

- Modular design permits easy installation, expansion or movement
  
- Maximizes square & cubic foot utilization as well as storage density using double and triple deck carousel stacking
  
- Maximizes throughput – no walking, searching or lifting – up to 600% increase in picking rate
  
- ‘Hot Picks’ can be integrated into system without disturbing the flow of downloaded stock orders
  
- Insertion/extraction robot can pick from multiple carousels
  
- Exacting quality of the picked item that conforms fully and reliably to customer requirements
  
- Computer software that is upgradeable
  
- High security of items stored as carousels are easily enclosed
  
- High capacity loads up to 1,000 lbs per bin
  
- Eliminates need for material handling indirect labor operators
  
- Typical stockroom and finished goods inventory reduction is 10%

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**SAVINGS**

**Labor Productivity**

*Gains up to 800% over the use of conventional shelving and racks and fork trucks are accomplished by eliminating wasted walk and search time.*

**Inventory Accuracy**

By providing accurate and timely inventory data, both the inventory levels and shortages can be reduced dramatically

**Space Reduction**

The carousels recover lost floor space by achieving the same storage capacity in *30% less space* than with static shelving.

**Fast Payback (ROI)**

Increased efficiencies allow companies to *recover their investment within 12-18 months.*

**High Throughput**

The use of Insert/Extract Robot optimizes throughput while lowering labor and space requirements

**Extended cut-off times**

Orders can be prioritized by computer based on shipping times and thus increases the ability to *ship more orders in a day.*

**Improved Service to your Customers**

Integrating inventory control software, light directed picking, and bar code scanning *assures up to 99.9% accuracy.*

**Equipment Reliability**

Durable and well engineered, carousels *provide nearly 100% uptime.*

**SAVINGS SUMMARY**

**SINGLE PALLET PICKING CELL**

OPERATORS REQUIRED TO PROCESS 910 PALLETS PER 7.5 WORK HOUR SHIFT

JOB CODE	CONVENTIONAL PALLET OPERATIONS WITH FORK TRUCK	CAROUSEL PALLET PICK WITH LIGHTREE SOFTWARE	USING A LABOR RATE OF \$20/HR (\$15/ HR + 33% FRINGE)
PALLET PUT-A-WAY	2.093	0.510	
PALLET PICK	3.495	0.480	
TOTAL	5.588	0.990	
MINUTES	5085	900	
WITH OPERATORS	11	2	9 OPERATORS SAVED
SAVINGS		82%	\$360,000
WITH ROBOTS	11	0	11 OPERATORS SAVED
SAVINGS		100%	\$440,000

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<b>PALLET TYPICAL PICK TIME</b>
TOTAL TYPICAL PICK TIME PER PALLET LOAD - MINUTES
TOTAL MIN .480 (2 <sup>ND</sup> LEVEL AVE) 1 OPERATOR = 935 PER 7.5 HR SHIFT = 125 PER HOUR 2 OPERATOR = 1870 PER 7.5 HR SHIFT = 250 PER HOUR

**TYPICAL - PALLETS PER PLATFORM and PALLETS PER  
SYSTEM BASED ON  
28 TOTAL PLATFORMS X 3 PALLET RACK LEVELS = 84 PALLETS X 2.5  
PALLET TURNS = (up to) 200 PALLETS (SKU'S) PER FAMILY**

	SINGLE PALLET PICKING CELL	DOUBLE PALLET PICKING CELL
ITEM	TWO 28 BIN UNITS	FOUR 14 BIN UNITS
LIGHT	UNDER 150 LBS 1 PALLET LOAD PER RACK LEVEL	UNDER 150 LBS 1 PALLET LOAD PER RACK LEVEL
MEDIUM	151 TO 350 LBS 1 PALLET LOAD PER RACK LEVEL	151 TO 350 LBS 1 PALLET LOAD PER RACK LEVEL
HEAVY	351 TO 500 LBS 1 PALLET LOAD PER RACK LEVEL	351 TO 500 LBS 1 PALLET LOAD PER RACK LEVEL
TOTAL	3 PALLET LOADS PER BIN 1000 LBS MAX	3 PALLET LOADS PER BIN 1000 LBS MAX

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**PALLET PUT-A-WAY**

SCAN LABEL OF PALLET LOAD IN STAGING LANE ____ READ HAND COMPUTER FOR PALLET RACK LOCATION.	.224	AUTOMATED
TRANSPORT PALLET LOAD OF CASES TO ROOM ____ - AISLE ____ WITH PALLET JACK TO PALLET RACK LOCATION – AVE 200 FT @ .00248 MIN PER FOOT (LOADED)	.496 EST	AUTOMATED
SCAN LABEL OF PALLET RACK. VERIFY ITEM DESCRIPTION (PALLET ID VS HAND COMPUTER).	.254	AUTOMATED
FIND PALLET LOCATON ON PALLET RACK LEVEL. VERIFY ITEM DESCRIPTION (PALLET ID VS HAND COMPUTER). VERIFY PALLET QUANTITY.	.088	AUTOMATED
PLACE ON PALLET ON PALLET RACK (2 <sup>ND</sup> LEVEL AVE)	.510	.510 (MANUAL)
READ HAND COMPUTER AND FINALIZE PALLET EXTRACTION TRANSACTION	.075	AUTOMATED
SUB TOTAL	.673	.510
RETURN PALLET JACK TO STAGING LANE - ROOM ____ - AISLE ____ - AVE 200 FT @ .00223 MIN PER FOOT (UNLOADED)	.446 EST	AUTOMATED
TOTAL		.510
SAVINGS	2.093	76%

**PALLET PICKING**

WORK ELEMENT	ELEMENTAL TIME	STATUS
READ HAND COMPUTER FOR NEW PALLET LOCATION	0.075	AUTOMATED
PALLET JACK FROM STAGING LANE TO ROOM - AISLE – PALLET RACK. AVE 200 FT @ .00223 MIN PER FOOT (UNLOADED)	.446 EST	AUTOMATED
SCAN LABEL OF PALLET RACK	.254	AUTOMATED
FIND PALLET ON STORAGE PALLET.	.030	AUTOMATED
VERIFY ITEM DESCRIPTION (PALLET ID ON PALLET VS HAND COMPUTER).	.030	AUTOMATED
VERIFY PALLET QUANTITY.	.028	AUTOMATED
REMOVE PALLET FROM STORAGE PALLET (2 <sup>ND</sup> LEVEL AVE)	.480	.480 (MANUAL)
READ HAND COMPUTER FOR NEXT PALLET LOCATION.	.075	AUTOMATED
SUB TOTAL	.643	.480
WRAP PLASTIC AROUND FULL PALLET LOAD – 5 FT H - 2 WRAPS	1.3010	AUTOMATED
PRINT LABEL AND APPLY TO PALLET LOAD	.280	AUTOMATED
TRANSPORT PALLET LOAD FROM (ROOM ____ & AISLE __) WITH PALLET JACK INCLUDES SCANNING ID OF STAGING LANE.	0.496	AUTOMATED
TOTAL	3.495	0.480
SAVINGS		86%



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**D. COST – FIXED  
INDUSTRIAL ENGINEERING PROPOSAL**

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**INDUSTRIAL ENGINEERING PROPOSAL  
SEMI-AUTOMATED MATERIALS HANDLING SYSTEM  
PALLET PUT-A-WAY AND PICK SYSTEM**

**28 TOTAL PLATFORMS X 3 PALLET RACK LEVELS = 84 PALLETS X 2.5 PALLET  
TURNOVERS = (up to) 200 PALLETS (SKU'S) PER FAMILY**

Service Activity	Fee Per Service Activity	Number of Pick Lists	Service & Fee Selection
Work Measurement of Each Sku's Dunnage Removal, Pallet Truck Removal, Sku Case Consolidation onto Pallet, Pallet to LSRS Pallet Rack Level for Storage, Pallet Pick from LSRS Pallet Rack Level, Pallet Label Application and Pallet Plastic Wrap	\$1,800	1	\$1,800
Line Balance of above using all LSRS Configurations and Pallet Rack Level with variable operators to attain optimum throughput	\$1,200	1	\$1,200
Final Pallet Put-a-way and Pick and Storage System (LSRS) and with Robots Equipment Specification/Quote	\$1,100	1	\$1,100
Pallet Utilization Determination in Existing Pallet Racks. Pallet Order Demand vs. JIT Critique	\$1,200	1	\$1,200
Develop a Phased Plan and Layout to Relocate Existing Pallet Racks during the Transition Period while maintaining Order Continuity.	\$1,000	1	\$1,000
LSRS Pallet Rack Level layout by weight	\$2,000	1	\$2,000
LSRS maximum output vs. Thru put capacity with various Job Code Line Balances	\$1,500	1	\$1,500
Work Station Detailed Layout	\$1,800	1	\$1,800
Work Station Visual Aids	\$1,500	1	\$1,500
Departmental Layout	\$ 600	1	\$ 600
Final Job Code Detailed Description	\$ 600	1	\$ 600
Work Station Instructions	\$ 900	1	\$ 900
Group Leader Training Including a Written Procedure for each Sku's Dunnage Removal, Pallet Truck Removal, Sku Case Consolidation onto Pallet, Pallet to LSRS Pallet Rack Level for Storage, Pallet Pick from LSRS Pallet Rack Level, Pallet Label Application and Pallet Plastic Wrap	\$ 600	1	\$ 600
LSRS System Set-up	\$1,000	1	\$1,000
LSRS System Installation	\$1,700	1	\$1,700
LSRS System Follow-up	\$1,500	1	\$1,500
Industrial Engineering Fixed Price	\$20,000	1	\$20,000
Travel Expenses – Air Travel, lodging and car rental on four monthly 10 day trips on-site	Travel Expenses Prepaid by Client		Travel Expenses Prepaid by Client
Per Diem Expenses to be billed at the conclusion of each month's activity	Per Diem Expenses Reimbursed by Client		Per Diem Expenses Reimbursed by Client

# JD GRAY ASSOCIATES INDUSTRIAL ENGINEERING CONSULTANTS

## Industrial Engineering Agreement

- JD Gray Associates shall submit detailed service fee invoices to Company. Said invoices shall contain a detailed itemization of the date(s) on which services were provided and a description of tasks completed during the period with respect to which the invoice is submitted. On-site travel expenses to be prepaid with the exception of per diem that will be submitted after each trip.
- Each compensation payment made by Company to JD Gray Associates shall be within 10 days.
- Company Property – JD Gray Associates agrees that any confidential information furnished by Company to JD Gray Associates or acquired by JD Gray Associates during the period in which JD Gray Associates is retained by Company is and shall remain the sole and exclusive property of Company and shall be placed in the hands of Company by JD Gray Associates upon termination of this Agreement including any copies made thereof.
- Confidentiality – JD Gray Associates agrees that at no time, either during or after the period in which JD Gray Associates is retained by Company shall JD Gray Associates utilize or disclose to any third party any of the confidential information of Company.

Date: \_\_\_\_\_ COMPANY OFFICIAL \_\_\_\_\_ Purchase Order Number: \_\_\_\_\_

### Industrial Engineering Contract Terms:

#### Payment Schedule

1. 20% upon approval and Purchase Order	\$4,000
2. 20% end of 1 <sup>st</sup> month	\$4,000
3. 20% end of 2 <sup>nd</sup> month	\$4,000
4. 20% end of 3 <sup>rd</sup> month	\$4,000
5. 20% upon implementation	\$4,000

If there are additional families desired to be added to our pick and pack paced conveyor industrial engineering service activity, an additional consulting fee of \$20,000 plus per diem travel expenses per family is required.

Five days per month on-site for five months for a total of 25 workdays.

Final Pallet Put-a-way and Pick and Storage System (LSRS) Equipment Specifications on



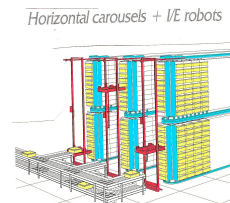
Pallet Live Roller  
Conveyor



Automatic Pallet Shrink  
Wrap Machine



PALLET LSRS



I/E ROBOT

We guarantee savings on productivity systems (LMS, Standards and Methods, Paced Assembly Production Lines, Industrial Incentives, Short-Interval-Scheduling, Labor Reporting and Semi-Automated Pick/Pack Systems) approved by your management and installed by us. Our consulting fees for lengthy projects or concurrent productivity system installations can be prorated on a **retainer** basis.

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**E. COST – BUDGET EQUIPMENT QUOTATION**

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**EQUIPMENT GENERAL SPECIFICATION  
AND  
BUDGET COST**

ITEM	A. PALLET PICK W/O ROBOTICS		B. PALLET PICK WITH ROBOTICS	
	1 PALLET PICK	2 PALLET PICK	1 PALLET PICK	2 PALLET PICK
1. STRECH WRAP	\$62,000	\$62,000	\$62,000	\$62,000
2. ALL OTHER CONVEYOR, PHOTO-EYES,	\$150,000	\$150,000	\$150,000	\$150,000
3. CAROUSELS, LIGHTTREE	56 PLATFORMS \$168,000	56 PLATFORMS \$168,000	56 PLATFORMS \$168,000	56 PLATFORMS \$168,000
4. COMPUTERS	\$44,000	\$44,000	\$44,000	\$44,000
5. DEBUG & TRAIN	\$45,000	\$45,000	\$45,000	\$45,000
6. ADD'L LSRS MOTORS, LIGHTTREE		\$67,000		\$67,000
7. ADD'L DEBUG & TRAIN		\$28,000		\$28,000
8. I/E ROBOT			\$160,000	\$160,000
<b>TOTAL</b>	<b>\$469,000</b>	<b>\$564,000</b>	<b>\$629,000</b>	<b>\$724,000</b>

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**1. STRETCH WRAP**

Configuration Aetna RotoPlat 3000HD Stretch Wrapper with 5 zone Pallet Live Roller Conveyor

Rotoplat 3000HD automatic turntable stretch wrapping machine  
Maximum Load Size 53"L x 48"W x 92"H  
Standard Load Size 48"L x 40"W x 92"  
Production Speed: Final Specifications to be supplied  
Maximum Load Weight 4,400 lbs.  
Steel mesh safety fence around the machine with access by safety limit switch  
Safety Light Barriers positioned at end of conveyors  
Allen Bradley Miclogix 1400 PLC with RS232 and Ethernet communication gate  
Allen Bradley Panel View 600 Plus  
Allen Bradley Variable Speed Drive for wrapper and turntable conveyor  
SEW Eurodrive motors for machine  
SEW Eurodrive motors for conveyor  
Automatic film cut, clamp and wipe system  
Turntable with powered roller conveyor 3" rollers on 3.4" centers, 51" between frames  
81.5" powered roller on In-feed and exit

**2. ALL OTHER CONVEYOR, PHOTO-EYES**

A Configuration- Lewco Pallet Live Roller Conveyor

1- Lot pf Live Roller Conveyor consisting of:  
Effective width 54"  
Roller Centers 6"  
Roller Diameter 2.5" 11ga  
Conveyor and transfer speed 30 fpm  
Elevation 18" TOR  
Support Centers 5'0"  
Drives ¾ HP 460V 3P 60 C  
Control Voltage 110V 1P 60C  
All transfers 2 Strand 36" apart

4- Transfer Assembly Mounted in Conveyor	3' L
2- Chain Driven Roller Conveyor Assembly	12' L
1- Chain Driven Roller Curve	90 degree
5- Chain Driven Roller Conveyor Assembly	5' L
2- Chain Driven Roller Conveyor Assembly	15' L
1- Chain Driven Roller Conveyor Assembly	5' L
1- Chain Driven Roller Conveyor Curve	90 degree
1- Chain Driven Roller Conveyor Assembly	22' L

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**8. I/E ROBOT**

**INSERT AND EXTRACT ROBOT** - Parallel jaw gripper, variable servo-controlled gripper clamping pressure, precision linear bearings on gripper clamp and reach axis, all electric operation, spring-set platform holding brake, chain break sensors and catch brakes on masts, over-speed sensor, path-clear sensors, automatic chain take-up, powder coat finish, stainless steel bed and software controls

**3.0 AND 6.0 CAROUSELS, LIGHTTREE**

Configuration - White Platform Horizontal Carousels	
Configuration	1 Pod of 2
Model Number:	WH Platform Horizontal Carousel
Length	Final Specifications to be supplied
Width	Final Specifications to be supplied
Height:	Final Specifications to be supplied
Available cube	Final Specifications to be supplied
Per carousel cube	Final Specifications to be supplied
Total System Cube	Final Specifications to be supplied
Estimated Live Load	Final Specifications to be supplied
Rated Live Load	Final Specifications to be supplied
Platform Dimensions	Final Specifications to be supplied
Platform Style	Final Specifications to be supplied
Speed	60 FPM
Drives	Dual 1.5 HP Drives
Access Panels	3
Track Lubricator	1
Controls:	1 - Motor Controller 1 - NEMA 12 Panel 1 - PLC and Cabling
Voltage Requirements:	480V/3P/60C
Photo Eyes	Front and Rear
Structure	Single Tier
Foot pedal	1 at Front and End of machine
Location Controls	Scott Tech software
Platform Numbers	Final Specifications to be supplied
Light Trees	1 at Front and 1 at Rear of Carousel Pod

**JD GRAY ASSOCIATES  
INDUSTRIAL ENGINEERING CONSULTANTS**

**4.0 COMPUTERS**

Configuration- Scott tech Software package with Computers and Scanners

PicPro Software to operate 1 Pod of carousels, 1- Lot of Live Roller Conveyor for the Putaway operation and Pick operation. Including the flow of material from the pick operation through the stretch wrapper and staged at the end of the conveyor line. Pick Pro to keep inventory in carousels and will be interfaced to the host system to allow a seamless flow of material within the Carousel System. RF Scanners are included to track material for put away, picking and stretch wrapping.

**5.0 AND 7.0**

Configuration FOB Destination Installed and Debugged with Training