JD GRAY ASSOCIATES
MANUFACTURING PRODUCTIVITY CONSULTANTS

TRANSMISSION, ENGINE
OR
OTHER HEAVY AND LARGE ASSEMBLIES

SEMI-AUTOMATED

PACED ASSEMBLY LINE EQUIPMENT

AND

INDUSTRIAL ENGINEERING

PROPOSALS

JD GRAY ASSOCIATES
MANUFACTURING PRODUCTIVITY CONSULTANTS

In the hope that our persistence will spark your interest in our capabilities I have prepared our *Paced Assembly with Robotics Equipment Proposal* and attendant *Industrial Engineering Services Proposal* that will customize (time study, line balance, work station instructions/tools/layout/visual aids/parts, training, implementation) your products to a semi-automated assembly line technique. I've used five assembly families (minimum number for contract) of different build sequences in the preparation and costing of our industrial engineering service proposal. Should our proposals be approved, please feel free to replace those families with others that may be more labor intensive.

As a matter of information, I have had a manufacturing productivity consulting business for over thirty years. JD Gray Associates utilizes a full time work force of four principals and has a network of contract industrial engineers located throughout the USA that is used when a job scope is beyond our staff capabilities. We also represent a conveyor manufacturer that is capable of producing linear or rotary assembly systems with or without in-line work cell robotics. Should a client purchase equipment with our manufacturer, the price quoted will not be exceeded for the specification stated and includes our finder's fee. This finder's fee is waived when our consulting services are retained.

Our proposed semi-automated assembly conveyor would incorporate the labor savings or output gain of our standards and methods program (15%), our paced assembly system (10%-25%) and our semi-automated cells (30%-35%) dependent on what level of labor controls you now have in-place. In addition to the preliminary conveyor equipment specification supplied, we will need your input regarding current cycle time of each family type, future desired shift output and existing component and sub assembly dimensions and weight to ensure the conveyor pallets are sized correctly and that there are sufficient in-line workstations to meet your throughput parameters. The final assembly conveyor configuration will be based on your answers to these and other questions as well as future on-site observations.

Typical operation of a Paced Assembly Line with Robotics system is as follows: 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 entire chain-driven string of 38 pallets will index automatically (eliminating manual movement of sub assembly from one station to another) approximately 72 inches at the same time at a speed of one foot per minute...then remain stationery for the time set on the variable dwell timer which will create a pace for the sixteen operators to finish their respective work task before a chime goes off indicating the dwell time has been depleted and signaling the next automatic index. We would develop a work task for each operator as well as instruction sheets and visual aids. There would be an assembly/test turntable and your fixture mounted to each of the aforementioned 38 pallets and because the unit is fixturized, future overhead robotic insertion could be used to mount components or add/remove the sub assembly to/from the turntable. There would be overhead lighting mounted to the conveyor system, a tool rail running the entire length of each side of the rotary conveyor and electrical/pneumatic outlets spaced at intervals servicing each of the sixteen operators. The variable speed-indexing feature adjusts traverse timing depending on pallet width. Work cell automation has been addressed by the addition of a precision pallet locating system. Customer provides actual robot and fixtures. Our equipment manufacturer has fixture and robot fabrication capabilities as well as PLC programming and if increasing the number of workstations at a future date is desired, they will expand the conveyor to whatever number of pallets required.

We are very experienced in these areas. We offer conveyor systems with robotic work cell equipment and/or attendant industrial engineering services. Should there be need of either, we stand ready to assist your management with its cost reduction goals.

Regards,

Joseph Gray
JD Gray Associates
www.jdgray-associates.com

JD GRAY ASSOCIATES
MANUFACTURING PRODUCTIVITY CONSULTANTS

SEMI-AUTOMATED MANUFACTURING SYSTEM PACED ASSEMBLY LINE WITH ROBOTICS

EQUIPMENT PROPOSAL AND PRELIMINARY SPECIFICATION

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EQUIPMENT PROPOSAL AND PRELIMINARY SPECIFICATION

1. Assembly Conveyor model number 72-72-32ccw-10,000lb capacity

1.1) (32) pallet machine, 72" in direction of travel counter-clockwise x 72" of work space available;
1.2) With a work height of 24";
1.3) An overall length of 112';
1.4) An overall width of 16';
1.5) Solid platform in center of Assembly Conveyor for future automation;
1.6) Powered by a 5 horsepower motor, (3) phase variable speed drive;
1.7) (2) sprockets, (1) drive sprocket, (1) take up sprocket.
1.8) Heavy duty drive chain with automatic chain oiler with on/off switch;
1.9) Wheel rail design pallet support;
1.10) Standard Assembly Conveyor color is safety blue unless otherwise specified.

2. Assembly Conveyor workstations

2.1) (16) assembly stations - 72" pallet x 72" deep.
2.2) (16) four position heavy duty turntables – 30"x 48". Turntables are 6" in height off of the pallets.
2.3) Turntable indexing is provided by a mechanical actuator located underneath the pallet. Turntable can index in 90 degree increments.

3. Offline unloading stations,

3.1) One offline unloading station will be custom fabricated to remove the unit from the final pallet.

4. Shot pin locating devices

4.1) Thirty-eight shot pin blocks and five locating devices are included for precision indexing of pallets.

5. Pneumatic outlets

5.1) Two disconnects centered under (16) workstations. Filter regulator and lubricator are included.

6. Electric outlets

6.1) (1) quad outlet receptacle centered under each of the (16) workstations.

7. Electrical emergency stops

7.1) Option number one would be a momentary switch emergency stop which would be located in a box in front of each workstation.
7.2) Option number two would have five centrally located emergency stops; one on each end, one on each side and one on the control panel.
7.3) An alarm would indicate an emergency stop has been activated.

8. System control package

8.1) All controls, motions, safety functions, input/output(s) and data collection will be interfaced through a Mitsubishi PLC. We will have to discuss the actual data collected and the format it is to be presented. We will incorporate HMI equipment (touch pad) and the training to use it, that will give the line controller the ability to call conveyor presets, dwell times, etc., and to slightly modify those times if necessary.
8.2) In accordance with your specifications, the program will incorporate only one (1) pallet station dwell time event, and that dwell event will be governed by any one of (8) presets. Each of these presets can then be modified up or down for productivity. Manual overrides will allow the program to ignore the chosen dwell if you simply want to allow the conveyor to make laps.
8.3) During production a warning alarm will sound at a predetermined time period before the conveyor actually starts/moves. This time period will be programmed, and therefore changeable.
8.4) Each station will feature an “E” stop (momentary push button) that will either freeze the moving conveyor or prevent it from starting. This “E” stop will not be a “start/stop” button that once it is activated, a remote reset button must be activated by the line controller.
8.5) The line controller will have ultimate on/off control of the conveyor line as well as the dwell time the invoked preset pallet dwell time will remain the same throughout the conveyors’ start/stop cycles until it is changed by the line controller.
8.6) Each of the (16) work stations will also feature a manually operated switch that when activated by the operator will illuminate an over station signal light that will indicate to the line controller a problem at that station.
8.7) The conveyor speed (ramp up/max speed/ramp down to top) will be adjustable. There will be a torque (current) limiting device used to drive the conveyor motor.

9. Timeline delivery schedule

9.1) Supply drawings with dimensions to scale including plan views and elevation views of conveyor system within two weeks of reward of bid. Upon acceptance of final drawings, an additional 10 weeks of fabrication. Two weeks of installation, setup, and training.

Total number of weeks: **14 weeks**.

10. Pricing

10.1) Sixteen Station custom designed Assembly Conveyor turnkey in 14 Weeks.

$650,000.00.

11. Terms

11.1) Letter of Credit. 50% upon receiving order; 25% upon test run in our facility; 25% upon shipment from our facility.

12. Warranty

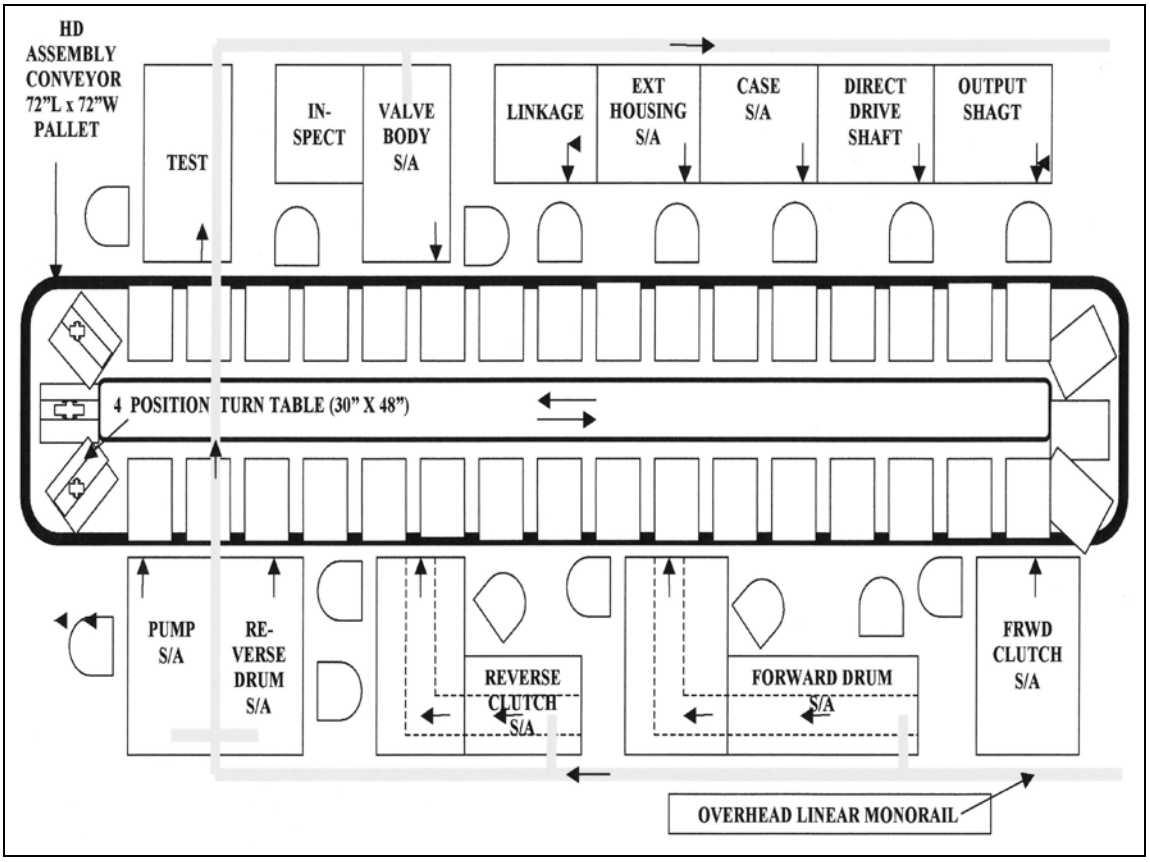
12.1) We use standard, high quality industrial grade components to manufacture our Assembly Conveyors. Those components are purchased with the manufacturers warranties. We will honor our personal warranty on our fabrications, assemblies and the general construction of the Assembly Conveyor. In the event of a non-electrical or pneumatic cylinder failure, we will replace or repair equipment as required within the first five years.
12.2) We will extend to you the first year performance maintenance schedule at no cost to assure that the maintenance is properly followed.

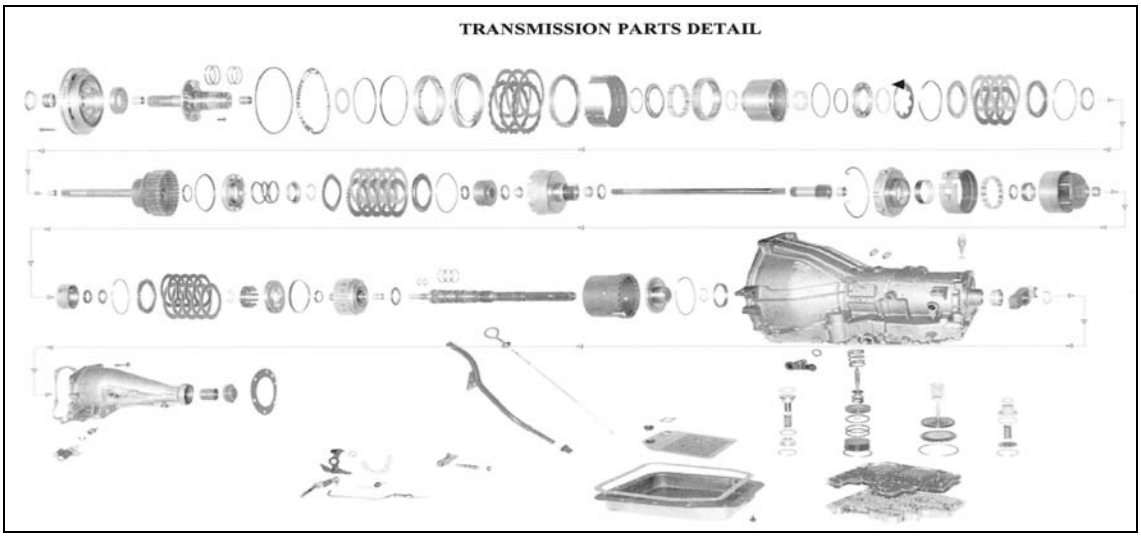
13. Training

13.1) Upon installation of our Assembly Conveyor we will provide operational training to your personnel as required.
13.2) A maintenance manual and component drawings will be provided.

This quote shall remain in effect for (45) days. We reserve the right to revise this quotation based on specific assembly criteria.

14. Conceptual Layout





15. Agreement

14.1) JD Gray Associates to perform aforementioned industrial engineering services on any Five Assembly Families selected by Client Company.

14.2) JD Gray Associates shall submit detailed service fee invoices to Client 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.

14.3) Each compensation payment made by Client Company to JD Gray Associates shall be within 10 days.

14.4) Client Company Property – JD Gray Associates agrees that any confidential information furnished by Client Company to JD Gray Associates or acquired by JD Gray Associates during the period in which JD Gray Associates is retained by Client Company is and shall remain the sole and exclusive property of Client Company and shall be placed in the hands of Client Company by JD Gray Associates upon termination of this Agreement including any copies made thereof.

14.5) Confidentiality – JD Gray Associates agrees that at no time, either during or after the period in which JD Gray Associates is retained by Client Company shall JD Gray Associates utilize or disclose to any third party any of the confidential information by Client Company.

Date: _____ COMPANY OFFICIAL_____

16. Authorization

Quotation Number Q1809

Date _____ Purchase Order No _____

_____ _____
(signature) (signature)
Client Company Official JD Gray Associates

JD GRAY ASSOCIATES
MANUFACTURING PRODUCTIVITY CONSULTANTS

Semi-Automated Manufacturing System
Paced Assembly With Robotics

Industrial Engineering Proposal

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JD GRAY ASSOCIATES
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1. Industrial Engineering Proposal – Option A

- **Client Company supplies video tape to JD Gray Associates in lieu of JD Gray Associates work measurement data collection on-site**
- **Client Company performs system installation**
- **Client Company performs equipment installation**

Semi-Automated Manufacturing System
Paced Assembly With Robotics

Phase One — Indexing Paced Conveyor System

- Phase One allows an upfront initial gain of 25%-40% before any automation takes place.
- The time-balanced Phase One System prepares for Phase Two Semi-Automation by eliminating future time bottlenecks for operations not to be mechanized.
- Our staff has time and motion, performance leveling, and split station methodology know-how developed over the processing of thousands of assemblies for the paced platform technique.

Five Assembly Families (Minimum)

Service Activity			Fee Per Family	Number of Families	Service & Fee Selection
Work Measurement (G)			$1,800	5	$9,000
Line Balance (G)			$1,200	5	$6,000
Final Equipment Specification/Quote (G)			$ 900	5	$4,500
Component Part Containerization			$1,200	5	$6,000
Work Station Layout (G)			$1,800	5	$9,000
Work Station Visual Aids			$1,500	5	$7,500
Work Station Fixtures/Tooling			$ 600	5	$3,000
Work Station Bill of Material			$ 600	5	$3,000
Work Station Instructions			$ 900	5	$4,500
System Training Manual including all of the above for each work station			$ 600	5	$3,000
Industrial Engineering Fixed Price			$11,100		$55,500

1.1 Option A Terms:

Payment Schedule

1. 20% upon approval and Purchase Order Assignment	$11,100
2. 20% end of 1st month	$11,100
3. 20% end of 2nd month	$11,100
4. 20% end of 3rd month	$11,100
5. 20% upon implementation	$11,100
Quotation Number	1807

An Letter of Credit is required from your bank to proceed.

Five Assembly Families (Minimum).

If there are additional families desired to be added to our assembly conveyor industrial engineering service activity, an additional consulting fee of $11,100 per family is required.

Phase Two — Semi-Automated Work Cells

- Phase Two includes custom robot design and fabrication, programming, and electrical and mechanical installation.
- The shot pin platform-locating device under the cell to be mechanized permits gradual Phase Two semi-automation and cost. Product mechanization leads to an additional 30-35% savings

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2. Industrial Engineering Proposal – Option B

- **JD Gray Associates performs on-site work measurement data collection on-site**
- **JD Gray Associates performs on-site system installation on-site**

- **Client Company performs equipment installation unless agreement with manufacturer under separate cover**

Should client company not want or be able to supply video of each existing operation, *on-site time study observation* will require an additional consulting fee of $4,000 per family. Should client want JD Gray Associates *on-site for system installation* an additional consulting fee of $5,000 per family will be required. Total additional consulting fee of $9,000 per family or $45,000 to be added to $55,500 or a total of $100,500 (Quotation 1808). First class travel expenses (airfare and hotel) for JD Gray Associates to be prepaid by client and should include interpreter as required, transportation and driver to/from airport and hotel, hotel and factory, factory and airport.

Five Assembly Families (Minimum)

Service Activity			Fee Per Family	Number of Families	Service & Fee Selection
Work Measurement (G)			$1,800	5	$9,000
Line Balance (G)			$1,200	5	$6,000
Final Equipment Specification/Quote (G)			$ 900	5	$4,500
Component Part Containerization			$1,200	5	$6,000
Work Station Layout (G)			$1,800	5	$9,000
Work Station Visual Aids			$1,500	5	$7,500
Work Station Fixtures/Tooling			$ 600	5	$3,000
Work Station Bill of Material			$ 600	5	$3,000
Work Station Instructions			$ 900	5	$4,500
Training Manual			$ 600	5	$3,000
On-site Observations			$4,000	5	$20,000
On-site System Installation			$5,000	5	$25,000
Equipment Installation			Client Company Factory Team to Perform		
Industrial Engineering Fixed Price			$20,100		$100,500

2.1 Option B Terms:

Payment Schedule

2. 20% upon approval and Purchase Order Assignment	$20,100
2. 20% end of 1st month	$20,100
3. 20% end of 2nd month	$20,100
5. 20% end of 3rd month	$20,100
5. 20% upon implementation	$20,100
Quotation Number	1808

An Letter of Credit is required from your bank to proceed.

Five Assembly Families (Minimum).

If there are additional families desired to be added to our assembly conveyor industrial engineering service activity, an additional consulting fee of $20,100 per family is required.

Phase Two — Semi-Automated Work Cells

- Phase Two includes custom robot design and fabrication, programming, and electrical and mechanical installation.
- The shot pin platform-locating device under the cell to be mechanized permits gradual Phase Two semi-automation and cost. Product mechanization leads to an additional 30-35% savings

JD GRAY ASSOCIATES
MANUFACTURING PRODUCTIVITY CONSULTANTS

3. Agreement

- JD Gray Associates to perform aforementioned industrial engineering services on any Five Assembly Families selected by Client Company.
- JD Gray Associates shall submit detailed service fee invoices to Client 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.
- Each compensation payment made by Client Company to JD Gray Associates shall be within 10 days.
- Client Company Property – JD Gray Associates agrees that any confidential information furnished by Client Company to JD Gray Associates or acquired by JD Gray Associates during the period in which JD Gray Associates is retained by Client Company is and shall remain the sole and exclusive property of Client Company and shall be placed in the hands of Client 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 Client Company shall JD Gray Associates utilize or disclose to any third party any of the confidential information by Client Company.

Date: _____ COMPANY OFFICIAL_____

4. Authorization

❑ **1. Option A** All offsite industrial engineering consulting services on Phase One performed by JD Gray Associates. Client Company to supply video of each existing operation for each family for the purpose of offsite time study by JD Gray Associates

Five family fee $55,500 Quotation Number Q1807

- OR –

❑ **2. Option B** All offsite industrial engineering consulting services on Phase One performed by JD Gray Associates except for *time study* observation and *systems installation* assistance that will be performed *onsite* by JD Gray Associates

Five family fee $100,500 Quotation Number Q1808

Date _____ Purchase Order No _____

_____ (signature)
Client
Company Official

_____ (signature)
JD Gray Associates

5. Conceptual Layout