

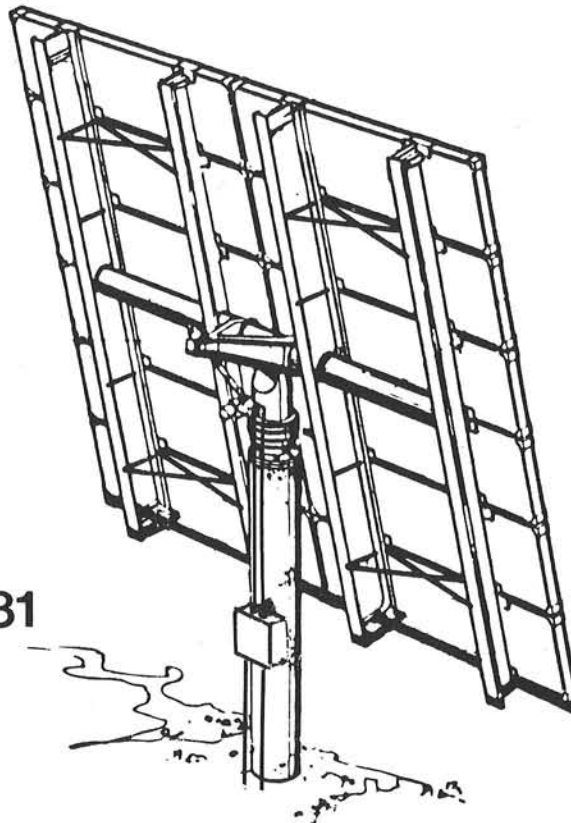
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Final Report

# **Second Generation Heliostat Development**

for SOLAR CENTRAL RECEIVERS



March 31, 1981

Detail Design Report  
Volume II - Appendices I, J

Appendix I

Production Planning and Cost Estimates  
Volume II, Appendices I, J

for

Gimbal Drive and Support Frame Assembly

Prepared by

Ford Motor Company  
and  
Ford Aerospace and Communications Corporation

Appendix I  
Production Planning and Cost Estimates  
for  
Gimbal Drive and Support Frame Assembly

I.1 General

This appendix was prepared by the Ford Motor Company and Ford Aerospace and Communications Corporation. The detailed information in this appendix was partly used to develop the production cost estimates shown in Appendix G.

I.2 Use of Information in this Appendix

The heliostat design and manufacturing scenario used to develop the costs shown in the appendix differ from those used to develop the collector subsystem costs shown in Appendix G. In particular, the costs reflected in the appendix are based on a one-piece torque tube, a highly mechanized site assembly process, and a "stand-alone" gimbal and frame manufacturing facility. Since this was not the approach chosen for the final manufacturing/assembly/cost analysis, only portions of the data in this appendix can be used. However, this data base is being published in this appendix to provide a record of the work performed by the Ford Motor Company.

# SECOND GENERATION HELIOSTAT MANUFACTURING STUDY

In Response to:  
Contract No. 7-A80562-9500

Submitted to:  
BOEING ENGINEERING AND CONSTRUCTION CO.  
P.O. BOX 3707  
SEATTLE, WASHINGTON 98124



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## Heliostat Manufacturing Study

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## Section 1.0

Heliostat Manufacturing StudySTUDY OBJECTIVES

- 1) Review all design information supplied by FACC Western Development Laboratories Division and provide input for manufacturing feasibility for production processes suitable for a 50,000/year capacity plant for a minimum of ten (10) years operation using two shifts.
- 2) Determine preliminary make/purchase sourcing plan for all parts and components and services.
- 3) Prepare manufacturing process estimate sheets on all "make" parts, sub-assemblies and assemblies. Sheets to include the following:
  - o Brief description of operation.
  - o Brief description of machines, equipment and tooling.
  - o Estimated net production per hour.
  - o Estimated work standard minutes.
  - o Estimated expenditures required for facilities and tooling.
- 4) Obtain estimated costs for all purchased finished parts and raw materials (casting, steel, etc.).
- 5) Provide total estimated expenditure and variable cost summaries and detail breakdown by part and item. Total estimates to be within  $\pm 20\%$  of eventual firm quotes, adjusted for economics.
- 6) Develop estimated manpower requirements by classification.
- 7) Develop block plant layout with estimated total area requirements.
- 8) Develop estimated building and site expenditures based on a manufacturing plant near Phoenix, Arizona and final assembly on utility sites within a 400 mile radius.
- 9) Develop estimated expenditures for all plant services including tool room, maintenance, cutter grind, quality control, layout and lab, etc.
- 10) Develop estimated program engineering, training, pre-activation and launch costs.
- 11) Based on a typical business plan, develop a methodology to determine a suggested selling price.



Section 2.0

Heliostat Manufacturing Study

PRODUCT DESIGN ASSUMPTIONS

The design information supplied by FACC for this manufacturing cost study consisted of prototype level layouts and part drawings plus verbal information and marked drawings.

The study includes the following components:

- Gimbal/actuator drive assembly designed by Ford Aerospace and Communications Corporation.
- Reflector panel support frame designed by Boeing Engineering and Construction Company.
- Assembly of the reflector panel support frame to the reflector panels which will have been manufactured at a mirror facility.

This information was reviewed for manufacturing feasibility on a production basis and several changes were proposed and agreed upon by FACC engineering to achieve more cost effective production level processes. The major changes and clarifications which were used as the basis for this study are listed in Section 10. Immediately following the detailed processing, a few adjusted costs were developed as outlined in the total variable cost, Section 6.

In addition to the manufacturing feasibility design changes agreed upon as a basis for developing this manufacturing cost study, there are other opportunities for achieving lower production costs. These opportunities require more engineering and source development time than was available for this study to evaluate their feasibility. These opportunities which should be considered in any future phases are listed in Section 11.



## Section 3.0

## Heliostat Manufacturing Study

MANUFACTURING ASSUMPTIONS

1. The manufacturing operations will produce 50,000 units per year on a (2) shift, (5) day, (49) week operating plan (3,920 annual hours). Service part requirements are included in the 50,000 volume requirements.
2. Manufacturing plant will be built near Phoenix, Arizona on a site with all infrastructure available to site boundaries.
3. No provisions will be made for future plant or capacity expansions.
4. Plant will produce (3) major shipping units, plus miscellaneous details for shipment to various utility sites where final heliostat assembly will be performed. The major shipping units are:
  - Gimbal/azimuth/bearing drive assembly
  - Elevation drive assembly
  - Torque tube and actuating arm assembly
5. The utility sites will assemble the final heliostat assemblies on a (2) shift, (5) day per week operating plan. No allowance has been made for severe weather which may cause the shutdown of operations in the field.
6. Study will include process and estimated expenditures and costs to complete the final assembly at the utility sites. This will include the installation of the reflector panels furnished by Boeing Co. and attachment of the complete heliostat to the Boeing provided pedestals.
7. All shipments will be via truck.
8. Minimal receiving inspection will be provided, assuming all suppliers are validated under a Quality Assurance Program.
9. Final testing of drive assemblies in the manufacturing plant will be minimal for operating function only.
10. The capability of outside suppliers to furnish the required volumes cannot be assumed at this time.
11. The make/buy pattern is preliminary and may be revised based on future supplier development and manufacturing cost studies.
12. All expenditure and cost estimates are based on 3rd Quarter 1980 economics and are assumed to be accurate, in total, within + or - 20% of eventual firm quotes.

## Section 4.0

## Heliostat Manufacturing Study

MAKE/BUY SOURCING PLAN

The detail variable costs sheets in Section 6.3 of this book identify the part sourcing decisions made for this study. These decisions must be considered preliminary and subject to review if further, more detailed, manufacturing engineering is undertaken. This detailed engineering is described as "Program Engineering" at Ford Motor Company, and is included as one of the costs estimated in this study (Section 9).

The major sourcing assumptions made are as follows:

- a) All major castings will be purchased outside and machined in-plant to provide control of the critical components and achieve total manufacturing costs that are probably lower than obtainable from outside machine shops at these volumes.
- b) All major non-standard components and assembly for the Planetary Drive/Bearing Assembly are sourced in-plant.
- c) Final assembly of the azimuth and elevation worm drive units is also sourced in-plant with the worm gearing purchased outside, and the acme thread S.S. shaft sourced in-plant because of difficulties in locating sources with sufficient capacity.
- d) The torque tube (one-piece design) will be purchased outside cut to length. In-plant the outer diameter will be expanded to the close tolerance size required in the ring fit areas.
- e) The flanges and rings to be welded to the tube in-plant will be purchased as form extruded sections in approximately 100" lengths. In-plant the material will be cut to length, ring rolled, end welded and expanded to I.D. size to fit the torque tube O.D. This method utilizes available capacity at the steel supplier for extruded mill sections and provides for good utilization of ring rolling, etc., equipment in-plant.
- f) The beams for the H-frame assembly will be purchased finished, made from pre-galvanized steel (galvalume process).
- g) Miscellaneous stampings are sourced in-plant with presses fully loaded.
- h) Various miscellaneous machined parts and weldments are sourced in-plant. These include pins, brackets, spacers, adapters, etc., which could be cycle run over common equipment to obtain good utilization. These parts should be reviewed for sourcing at a later date by obtaining quotes from small local outside suppliers who may have available time on existing equipment.



## Heliostat Manufacturing Study

MANUFACTURING PLANI. Manufacturing Plant

General - The Heliostat manufacturing plant is basically planned to be similar to a low or medium volume automotive manufacturing plant with labor intensive part handling. The 50,000 annual volume at a line rate of 13 units per hour (net) does not justify the additional expenditure required for transfer type machining and press lines and/or automatic handling equipment between operations.

Machining Operations - Machines will be basically stand-alone (either standard or specially designed) automatic cycle production types with parts transferred between machines by using manual roller conveyors or bins and industrial trucks. "Standard" machines include horizontal and vertical lathes and milling machines, grinding machines, drill presses, hones, hobbers, shavers and boring machines.

Special design machines include two, three and four-way precision boring machines as well as multiple station in-line shuttle or rotary index milling and drilling machines. Most operations require special tooling such as part holding fixtures and gages. The majority of the fixtures will be designed for automatic power clamping and manual load and unload. Special tooling also includes multi-spindle heads for drilling, tapping, reaming, boring and milling operations as well as multi-tool boring and facing bars. Gages for the more complex or critical parts include special designed composite electronic gaging that will provide highly accurate functional checking capabilities.

Assembly Operations - Assembly operations will include the gimbal/azimuth/bearing drive assembly and the elevation drive assembly. In general, sub-assemblies will be performed on off-line manual fixtures using pneumatic nutrunners to secure the bolts. A small conveyor will be used for final assembly of the azimuth drive/bearing/gimbal assembly.

The above (2) drive assemblies will go through a paint operation and be shipped to a utility site for final assembly and mounting of the complete heliostat.

Metal Forming Operations - All stampings with the exception of the H-Frame beams have been sourced in-plant for this study. The parts will be processed by cycle running over (2) shears and (9) presses ranging in capacity from (80) to (500) tons. The cycle running is based on a (30) work day cycle with sheet steel being purchased for 60 to 90 day runs and sheared to blank size in-plant. The presses are fully loaded for good facility utilization.

The torque tube will be purchased cutoff with an undersized outer diameter and expanded to size in-plant on a Grotnes tube expander machine.

The rings and adapter will be purchased as mill rolled steel bars and roll formed and welded into a ring on a Grotnes roll former and expanded to size on a Grotnes tube expander.

Material Handling - It has been assumed that all material will be received and shipped by truck. A five-day float will be stored ahead of the manufacturing and assembly operations. The torque tubes and castings received via flatbed trucks will be unloaded and stored outside.

Sheet metal and bar stock will be unloaded and stored inside the building.

Purchased parts (bearings, seals, etc.) will be unloaded at a two-spot depressed dock, and stored inside the building in a stores area. Material will be delivered to the line operations by trailer train and fork trucks.

A five-day float of shipping assemblies (torque tube, azimuth, elevation and small parts) will be stored outside the manufacturing building.

Components for twenty Heliostat assemblies will be shipped on 40' trailers to the field assembly sites. The reflector panels and the support beams will be shipped direct to the field assembly sites by the suppliers.

No equipment for the repair of industrial trucks has been provided. Industrial truck repair and service has been assumed to be contracted to outside local sources.

Galvanizing Operations - The galvanizing operation will consist of a series of dip tanks, each 35 feet long by 4 feet wide and 5 feet deep suitably constructed of plate steel with protective lining and a semi-automatic handling system between the tanks. The tanks will include a lip-vent, down draft exhaust system. The exhaust from the galvanizing tank will be vented to a bag house where the zinc particles will be trapped and the cleaned air discharged. The pickling and after pickling rinse tanks will be exhausted into a filtration system where the acids and water will be separated, cleaned and recycled. The residue will be neutralized before being discharged.

It is proposed to house this system in a laminated wood structure, separate from the main manufacturing building. The laminated wood can better resist the corrosiveness of this operation than the masonry and steel construction of the manufacturing building and its contents.

Paint System - Castings as received from the supplier foundries will be required to have been cleaned to remove sand, scale, etc., followed by an iron phosphate coating and a dip coat primer paint. The primer paint will be specified to be compatible with the final protective coatings to be applied at the Heliostat Manufacturing Plant.

Following final assembly and test, the gimbal/azimuth/bearing drive assembly and the elevation drive assembly will be given a manual solvent wipe prior to application of the final protective coatings. The proposed process for these coatings consists of a prime coat of epoxy chromate, followed by a baking cycle, a return through the paint booth for a second application of a topcoat of acrylic urethane color, and then a second baking cycle.

The paint system will consist of the following equipment: Sidedraft "waterwash" spray booth with air make-up system, solvent flash-off enclosure, infra-red paint drying oven and an overhead monorail conveyor.



## II. Final Field Assembly Plant (On Utility Sites)

Assembly Operations - Two utility sites will be in operation simultaneously to assemble the complete Heliostat units at the rate of (8) units per hour on a two-shift basis. The finished Heliostat assemblies will be transferred to the installation points using special transport trailers on a one-shift basis. The total time required to assemble 6900 units at each utility site is approximately (11) weeks assuming no severe weather which might prohibit the installation of the units. Start up of the assembly operations will be staggered for the two utility sites. A building at the third site will be prepared so that after the first field assembly site has completed operations, the work force and assembly equipment can be transferred and operations at the next site can begin with minimum delay.

After the work force have moved from the first site, the building and building equipment (except for portion required for field maintenance) will be dismantled and transferred and reassembled at the next utility site. In order to complete 50,000 installations each year working two sites at a time, each work force will be required to move to a new site (4) times per year or complete a total of (8) sites per year.

In general, the Heliostat final assembly operations will be performed in manual fixtures using pneumatic nutrunners and hand torque wrenches to secure the nuts and bolts. A drag conveyor will be used to move the final assembly fixtures through the plant.

Major components going into the final assembly fixtures include the gimbal/azimuth/bearing drive assembly, the elevator drive assembly, the torque tube and actuating arm assembly, the (4) support beams and the (12) reflector panels. Sub-assembly of the support beams and reflector panels will require off-line fixtures.

Because of the size and weight of the major components, a series of overhead bridges and hoists using special handling devices will be required to transfer parts or assemblies into or out of the assembly fixtures. Completed Heliostat units will be transferred from the fixtures to special transport trailers.

At the installation point, the Heliostat units will be mounted to previously installed pedestals and secured with nuts.

Material Handling - Fork trucks and tow tractors will be used to unload and deliver parts to the assembly operations.

Special trailers will be used to transport the complete assembly to the pedestal field. Specially equipped vehicles will be used to mount the Heliostat to the pedestals.

No equipment for industrial truck repair has been provided. Service and repair has been assumed to be contracted to outside local sources.



Section 6.0

Heliostat Manufacturing Study

VARIABLE COST

- Section 6.1      Summary of Variable Cost
- Section 6.2      Variable Cost Breakdown by Components
- Section 6.3      Variable Cost Detail by Item
- Section 6.4      Work Standards (Standard Processing Minutes per  
Piece and per Unit)
- Section 6.5      Manpower Requirements for Plant Operation



Section 6.1

Heliostat Manufacturing Study

SUMMARY OF VARIABLE COST

50,000 Units Per Year

\$ PER UNIT

	<u>RAW MATERIAL COST</u>	<u>PURCHASED FINISHED PARTS COST</u>	<u>LABOR &amp; VARIABLE BURDEN COST</u>	<u>TOTAL VARIABLE COST</u>
<u>I. MANUFACTURING PLANT</u>				
Gimbal & Azimuth Drive/Bearing Assembly	\$349	\$122	\$165	\$ 636
Elevation Drive Assembly	70	105	87	262
Reflector Panel H-Frame Assemblies	19	262	15	296
Reflector Panel Attachment Brackets	29	18	32	79
Torque Tube Assembly	153		22	175
Arm Assembly	39		16	55
Hardware and Detail Items	23	9	10	42
Production Processes	<u>24</u>		<u>47</u>	<u>71</u>
Subtotals	\$706	\$516	\$394	\$1616
Elevation and Azimuth Motors		149		149
Electrical Wiring and Supports	1	48	2	51
Sensors and Attachments	<u>2</u>	<u>40</u>	<u>20</u>	<u>62</u>
Total Manufacturing	\$709	\$753	\$416.	\$1878
<u>II. FIELD ASSEMBLY PLANT</u>				
On Site Heliostat Assembly			\$112	\$ 112
TOTAL				<u>\$1990</u>

\* Includes galvanizing material and weld wire in addition to iron castings and steel.

\*\* Direct Labor Cost is based on a base standard of 10.00 hours per unit with an estimated operating performance, adjusted for volume levels of 35% off standard. Average base wage rate for direct labor has been assumed at \$7.50 per hour.

## Heliostat Manufacturing Study

VARIABLE COST BREAKDOWN BY COMPONENTS

50,000 Units Per Year

I. MANUFACTURING PLANTGIMBAL and AZIMUTH DRIVE/BEARING ASSEMBLY

<u>PART</u>	<u>ITEM NUMBER</u>	<u>MATERIAL COST</u>	<u>PURCHASED PARTS COST</u>	<u>LABOR &amp; BURDEN COST</u>	<u>TOTAL VARIABLE COST</u>
Assembly	D-651133-18			\$ 34.33	\$ 34.33
Input Worm, Housing, Cap, Cover	1-3	\$ 13.955		25.65	39.605
Input Worm, H.S. Worm	4		\$ 19.48		19.48
Input Worm, S.S. Shaft	5	1.091		16.80	17.891
Input Worm, Gear	6		11.18		11.18
Input Worm, Spacers, Bushings	7-9	.275		4.30	4.575
Input Worm, Miscellaneous	10-22		19.977		19.977
Input Worm, Hardware	43-45, 50, 52-54, 62		1.541		1.541
Planetary, Base/Cover	23-24	118.00*		12.71	130.71*
Planetary, Planets	25-26	66.97		25.15	92.12
Planetary, Ring Gears	27-28	87.00*		27.09	114.09*
Planetary, Rings, Pinion, Pins	29-31	.542	16.28	6.46	23.282
Planetary, Miscellaneous	33-40, 42	.14	25.065	.66	25.865
Planetary, Clamp Seal	41		20.00*		20.00*
Planetary, Hardware	46-49, 51, 55, 61, 63		6.536		6.536
Motor Attachments	56-60	5.73	1.658	6.11	13.498
Gimbal Housing	531146	55.20		6.27	61.47
TOTALS		\$349.	\$122.	\$165.	\$636.

\* Adjusted Cost - See Sheet 8

  
 Ford Aerospace &  
 Communications Corporation

ELEVATION DRIVE ASSEMBLY

<u>PART</u>	<u>ITEM NUMBER</u>	<u>MATERIAL COST</u>	<u>PURCHASED PARTS COST</u>	<u>LABOR &amp; BURDEN COST</u>	<u>TOTAL VARIABLE COST</u>
Assembly	D-651140-18			\$18.45	\$ 18.45
Housings	1-6	\$23.768		37.24	61.008
S.S. Shaft	8	36.38		12.56	48.94
Spacers, Cups, Cones	9-18	.104	\$ 21.888	2.45	24.442
Gaskets and Seals	19-24		4.925		4.925
S.S. Seal & Clamp	25-26		6.00*		6.00*
Stop Collars	27-28	4.091		9.83	13.921
Nut	29		17.09		17.09
Hardware	30-38, 41-49		2.862		2.862
Worms, Gears	50-53		48.99		48.99
Motor Attachments	7, 39-40	<u>5.73</u>	<u>3.785</u>	<u>6.11</u>	<u>15.625</u>
TOTALS		\$70.	\$105.	\$87.	\$262.

Ford Motor Company



\* Adjusted Cost - See Sheet 8

<u>REFLECTOR PANEL H-FRAME ASSEMBLY</u>		<u>MATERIAL COST</u>	<u>PURCHASED PARTS COST</u>	<u>LABOR &amp; BURDEN COST</u>	<u>TOTAL VARIABLE COST</u>
Beams	277-10122-5/6		\$253.60		\$253.60
Angles, Bars, Struts	277-10120-4/5/8/12	\$19.12		\$15.02	34.14
Hardware	277-10120		<u>7.773</u>		<u>7.773</u>
TOTALS		\$19.	\$626.	\$15.	\$296.

<u>REFLECTOR PANEL ATTACHMENT BRACKET</u>					
Subassembly	277-10119			2.92	2.92
Attachment Plates	277-10119-13/14/17	6.24		15.31	21.55
Doubler and Bracket	277-10119-18/19	22.56		13.86	36.42
Nylon	277-10119-15/16/20		<u>18.24</u>		<u>18.24</u>
TOTALS		\$29.	\$ 18.	\$32.	\$ 79.

TORQUE TUBE ASSEMBLY

		<u>MATERIAL COST</u>	<u>PURCHASED PARTS COST</u>	<u>LABOR &amp; BURDEN COST</u>	<u>TOTAL VARIABLE COST</u>
Assembly	SK-6130-002			\$ 2.59	\$ 2.59
Torque Tube	SK-6130-002-02	\$ 87.88		1.94	89.82
Flanges	SK-6130-002-3/4	43.48		12.30	55.78
Adapter Ring	531439-A	<u>21.74</u>		<u>5.18</u>	<u>26.92</u>
TOTAL		\$153.		\$22.	\$175.

ARM ASSEMBLY

Assembly, Arms, Bracers	531147	\$ 14.60		\$ 4.70	\$ 19.30
Swivel Ext/Ring Adapter		<u>24.84</u>		<u>11.04</u>	<u>35.88</u>
TOTAL		\$ 39.		\$16.	\$ 55.



<u>GIMBAL/ACTUATOR HARDWARE AND DETAIL ITEMS</u>		<u>MATERIAL COST</u>	<u>PURCHASED PARTS COST</u>	<u>LABOR &amp; BURDEN COST</u>	<u>TOTAL VARIABLE COST</u>
Elev. Drive Trunnion	531442-01	\$21.40		\$ 7.37	\$28.77
Elev. Brg. and Pivot Pins	531442-16/17	1.51		3.05	4.56
Hardware	531442		\$ 2.572		2.572
Lubricant	531436-83		<u>6.16</u>		<u>6.16</u>
TOTALS		\$23.	\$ 9.	\$10.	\$42.
 <u>PRODUCTION PROCESSES</u>					
Galvanizing		\$24.00		\$10.36	\$34.36
Heat Treatment				10.36	10.36
Paint					*
Tear Down and Repair				<u>26.42</u>	<u>26.42</u>
TOTALS		\$24.		\$47.	\$71.

\* Adjusted Cost - See Sheet 8

  
 Ford Aerospace &  
 Communications Corporation

	<u>MATERIAL COST</u>	<u>PURCHASED PARTS COST</u>	<u>LABOR &amp; BURDEN COST</u>	<u>TOTAL VARIABLE COST</u>
<u>MOTORS</u>				
Elevation Motor		\$ 82.62		\$ 82.62
Azimuth Motor		<u>66.65</u>		<u>66.65</u>
TOTAL		\$149.		\$149.
<u>ELECTRICAL WIRING</u>				
Electrical Wiring		\$ 45.00		\$ 45.00
Support/Grommet/Grips	<u>\$ 1.00*</u>	<u>3.00*</u>	<u>\$ 2.00*</u>	<u>6.00*</u>
TOTAL	\$ 1.	\$ 48.	\$ 2.	\$ 51.
<u>SENSORS AND ATTACHMENTS</u>				
Sensors/PC Board/ Mount	\$ .14	\$ 24.00	\$ 5.95	\$ 30.09
Magnet Holders		11.60		11.60
Brackets	2.00*		14.00*	16.00*
Hardware		<u>3.77</u>		<u>3.77</u>
TOTAL	\$ 2.	\$ 40.	\$20.	\$ 62.

  
 Ford Motor Company

\* Adjusted Cost - See Sheet 8




11. FIELD ASSEMBLY PLANT

## ON-SITE HELIOSTAT ASSEMBLY

	<u>MATERIAL COST</u>	<u>PURCHASED PARTS COST</u>	<u>LABOR &amp; BURDEN COST</u>	<u>TOTAL VARIABLE COST</u>
Load Gimbal Assembly into fixture			\$ .54	\$ .54
Assemble Elevation Drive to Gimbal			.76	.76
Assemble Torque Tube to Gimbal			1.40	1.40
Assemble Elev. Drive to Torque Tube			1.46	1.46
Sub-assemble Angles to Refl. Beams			7.89	7.89
Sub-assemble Bars to Refl. Beams			1.84	1.84
Assemble Refl. Beams to Torque Tube			10.91	10.91
Assemble Struts to Refl. Beams			3.13	3.13
Sub-assemble Panel Attachment Brackets			36.30	36.30
Assemble Panels to Refl. Beams			23.99	23.99
Lock wire Reflector to Angle/Bar			11.77	11.77
Remove Heliostat Assembly from fixture			2.48	2.48
Install Heliostat Assembly to Pedestal			9.29	9.29
			\$112.	\$112.
TOTALS			\$112.	\$112.

ADJUSTED VARIABLE COSTS

Sheet 8


 Ford Aerospace & Communications Corporation

FIRST COST = ADJUSTED  
 (SECOND COST) = ORIGINAL DETAIL

	<u>MATERIAL COST</u>	<u>PURCHASED PARTS COST</u>	<u>LABOR &amp; BURDEN COST</u>	<u>TOTAL VARIABLE COST</u>
Planetary, Base/Cover	\$118.00(156.53)		\$ 12.71(12.71)	\$ 130.71(169.34)
Planetary, Ring Gears	87.00(95.28)		27.09(27.09)	114.09(122.37)
Planetary, Clamp Seal		20.00(69.37)		20.00(69.37)
Elev. S.S. Seal & Clamp		6.00(12.76)		6.00(12.76)
Paint	----(5.97)		----(15.58)	----(21.55)
Wiring Supports	1.00(2.97)	3.00(8.62)	2.00(3.56)	6.00(15.15)
Sensor Brackets	<u>2.00(4.92)</u>		<u>14.00(41.86)</u>	<u>16.00(46.78)</u>
	\$208.00(265.77)	\$ 29.00(90.75)	\$ 55.80(100.80)	\$ 292.80(457.32)
 <u>MANUFACTURING PLANT TOTALS</u>				
Original Detail	\$767.25	\$813.99	\$461.45	\$2042.78
Adjusted Cost Reduction	<u>57.77</u>	<u>61.75</u>	<u>45.00</u>	<u>164.52</u>
New Total	\$709	\$753	\$416	\$1878

Ford Motor Company



Section 6.3 VARIABLE COST DETAIL

The variable cost for each item is detailed on the following six sheets.

Sourcing indicates the make/buy decisions discussed in Section 4.0.

Manufacturing processes for all "make" items are itemized on the process estimate sheets in Appendix A, which also include process sequence sketches for the manufacturing tasks associated with each item.

The direct labor work standard in Section 6.4 itemizes the standard minutes per piece and per unit for each item.



Heliostat Manufacturing Study

VARIABLE COST DETAIL

50,000 UNITS PER YEAR

I - MANUFACTURING PLANT

Part Nomenclature	Part Number	Item Number	Quantity	Sourcing	Total Material Cost	Total Purchased Parts Cost	Direct Labor Cost	Variable Burden Cost	Total Variable Cost	Vendor Tooling Cost
Azimuth Drive Assembly	D-651133-18		1	Assembly			\$7.63	\$26.70	\$34.33	
Worm Gear Housing	790234	1	1	Make	\$10.58		2.81	9.82	23.21	\$15,900
H. S. Cap	800240	2	1	Make	.795		1.65	5.78	8.225	-
S. S. Cover	800241	3	1	Make	2.58		1.24	4.35	8.17	6,700
H. S. Worm	860990	4	1	Purchase		\$19.48	-	-	19.48	5,000
S. S. Shaft	830234	5	1	Make	1.091		3.73	13.07	17.891	
S. S. Worm Gear	900990	6	1	Purchase		11.18	-	-	11.18	5,000
S. S. Shaft Spacer-Short	835235	7	1	Make	.039		.29	1.02	1.349	-
S. S. Shaft Spacer-Long	835236	8	1	Make	.039		.30	1.04	1.379	-
H. S. Housing Bushing	835234	9	1	Make	.197		.37	1.28	1.847	-
H. S. Cap Gasket	815486	10	1	Purchase		.046	-	-	.046	150
S. S. Cover Gasket	815487	11	1	Purchase		.025	-	-	.025	150
Encoder Sft. Ball Brg. (MRC 3822)	20303	12	1	Purchase		3.63	-	-	3.63	-
H. S. Ball Bearing (MRC 2034)	20118	13	2	Purchase		5.38	-	-	5.38	-
S. S. Ball Bearing (MRC 2065)	20207	15	1	Purchase		4.02	-	-	4.02	-
Spiralox Retaining Ring (RST-66)	10271	16	1	Purchase		.028	-	-	.028	-
Truarc Retaining Ring (N-5000-156)	10139	17	1	Purchase		.072	-	-	.072	-
Truarc Support Washer (5900-66)	10275	18	1	Purchase		.069	-	-	.069	-
H. S. Seal (CR 6630 CRW 1)	30172	19	3	Purchase		1.98	-	-	1.98	-
H. S. Seal (CR 6660 CRW 1)	30173	20	1	Purchase		.71	-	-	.71	-
S. S. Seal (CR 11610 CRW 1)	30174	21	4	Purchase		3.12	-	-	3.12	-
Alemite Grease Fitting (1684 B)	13746	22	1	Purchase		.897	-	-	.897	-
Base	926610	23	1	Make	93.15 *		1.07	3.74	97.96 *	15,100
Cover	926220	24	1	Make	63.48 *		1.76	6.14	71.38 *	10,100
Planet Gear	936140	25	3	Make	30.12		4.86	17.01	51.99	5,800
Planetary Frame	936310	26	1	Make	36.85		.73	2.55	40.13	4,575
Primary Ring Gear	936710	27	1	Make	58.64 *		3.03	10.60	72.27 *	2,205
Secondary Ring Gear	936440	28	1	Make	36.64		2.99	10.47	50.10	1,518
Friction Ring	926360	29	6	Make	.236		.31	1.10	1.646	-
H. S. Pinion	936060	30	1	Purchase		16.28	-	-	16.28	7,000
Journal Pin	926361	31	3	Make	.306		1.12	3.93	5.356	-
Base Gasket	926911	33	1	Purchase		1.43	-	-	1.43	300
Cover Gasket	926910	34	1	Purchase		1.43	-	-	1.43	300
Ball-Load	926914	35	66	Purchase		2.97	-	-	2.970	-
Ball Spacer	926915	36	66	Purchase		2.97	-	-	2.970	-
Ball Retaining Bolt	926913	37	1	Make	.14		.15	.51	.80	-
Torrington Needle Bearing (HJ101812)	20304	38	6	Purchase		15.30	-	-	15.30	-
Locknut	176	39	1	Purchase		.123	-	-	.123	-
Dowty "O" Ring (No. 200-908)	50170	40	1	Purchase		.028	-	-	.028	-
C/R Axial Clamp Ser.No. 524363	30171	41	1	Purchase		69.37 *	-	-	69.37 *	-
3/16 x 1 Spirol Pin	10531	42	12	Purchase		.814	-	-	.814	-
1/4 x 20 x .75 Ig. Hex. Hd. Bolt	11702	43	4	Purchase		.147	-	-	.147	-
1/4 x 20 x 1 3/8 Hex. Hd. Bolt	11703	44	4	Purchase		.157	-	-	.157	-
3/8 x 16 x 1.75 Ig. Hex. Hd. Bolt	11743	45	4	Purchase		.176	-	-	.176	-

Part Nomenclature	Part Number	Item Number	Quantity	Sourcing	Total Material Cost	Total Purchased Parts Cost	Direct Labor Cost	Variable Burden Cost	Total Variable Cost	Vendor Tooling Cost
1/2 - 13 x 2 Lg. Hex. Hd. Bolt	12323	46	4	Purchase		\$ .312	\$ -	\$ -	\$ .312	\$ -
1/2 - 13 x 1 1/2 Lg. Hex. Hd. Bolt	11786	47	18	Purchase		1.152	-	-	1.152	-
1/4 - 20 x 5/8 Lg. Hex. Hd. Bolt	11701	48	2	Purchase		.022	-	-	.022	-
1/8 x 1/8 x 3/4 Pinion Key	15008	49	1	Purchase		.023	-	-	.023	-
1/4 x 1/4 / 5/8 Gear Key	15231	50	1	Purchase		.031	-	-	.031	-
3/8 Pipe Plug	11141	51	1	Purchase		.035	-	-	.035	-
1/8 Pipe Plug	11104	52	3	Purchase		.12	-	-	.12	-
1/4 Lockwasher	13213	53	14	Purchase		.17	-	-	.17	-
3/8 Lockwasher	13230	54	4	Purchase		.06	-	-	.06	-
1/2 Lockwasher	13250	55	30	Purchase		.48	-	-	.48	-
L-050 LoveJoy Coupling	100000	56	1	Purchase		1.40	-	-	1.40	-
Motor Adapter (Use 651140-18 Det.7)	805000	57	1	Make	\$ 5.73		1.11	5.00	11.84	9,600
1/4 - 20 x 3/4 Lg. Soc. Hd. Screws	12242	58	4	Purchase		.104	-	-	.104	-
1/8 x 1/8 x 1/2 Coupling Key	15009	59	1	Purchase		.034	-	-	.034	-
1/4 Pipe Plug	11122	60	2	Purchase		.12	-	-	.12	-
1/2 - 13 x 3 3/4 Lg. Hex. Hd. Bolts	11776	61	12	Purchase		1.632	-	-	1.632	-
Spacer	835237	62	4	Purchase		.68	-	-	.68	-
Spacer	835238	63	12	Purchase		2.88	-	-	2.88	-
Gimbal Housing	531146		1	Make	55.20		1.39	4.88	61.47	11,200
<u>Elevation Drive Assembly</u>	0651140-18		1	Assembly			4.10	14.35	18.45	-
Housing	0651140-22	1	1	Make	11.96		4.01	14.03	30.00	17,400
Attachment Housing	C-651140-46	2	1	Make	6.90		2.22	7.78	16.90	17,400
Attachment Housing Cover	5510	3	1	Make	.404		.07	.23	.704	-
H. S. Cap Closed	4485	4	1	Make	.35		.38	1.34	2.07	4,800
S. S. Cover - No print	B-651140-20	5	1	Make	3.82		.85	2.97	7.64	8,400
H. S. Cap	A-651140-45	6	1	Make	.334		.75	2.61	3.694	-
Motor Adapter	7922	7	1	Make	5.73		1.11	5.00	11.84	9,600
S. S. Shaft	B-651140-23	8	1	Make	36.38		2.79	9.77	48.94	-
S. S. Spacer	A-651140-21	9	1	Make	.070		.30	1.05	1.42	-
S. S. Shaft Washer	A-651140-44	10	1	Make	.034		.24	.86	1.134	-
S. S. Timkin Cone (No. 43125)	20308	11	1	Purchase		3.774	-	-	3.774	-
S. S. Timkin Cup (No. 43312)	20509	12	1	Purchase		1.714	-	-	1.714	-
S. S. Timkin Cone (No. 27881)	20310	13	1	Purchase		3.069	-	-	3.069	-
S. S. Timkin Cup (No. 27820)	20077	14	1	Purchase		1.821	-	-	1.821	-
Int. Timkin Cone (No. 05062)	3370	15	2	Purchase		3.886	-	-	3.886	-
Int. Timkin Cup (No. 04185)	3371	16	2	Purchase		1.744	-	-	1.744	-
H. S. Timkin Cone (No. A6062)	3336	17	2	Purchase		4.168	-	-	4.168	-
H. S. Timkin Cup (No. A6151)	3337	18	2	Purchase		1.712	-	-	1.712	-
S. S. Cover Gasket	A-651140-24	19	1	Purchase		.045	-	-	.045	-
Inter Gasket	4487	20	2	Purchase		.022	-	-	.022	150
H. S. Cap Gasket	4370	21	2	Purchase		.016	-	-	.016	150
Attachment Housing Gasket	5521	22	1	Purchase		.022	-	-	.022	150
H. S. Seal Garlock 63 x 51	3301	23	4	Purchase		3.04	-	-	3.04	-
S. S. Seal C/R 14939 CRW1	30026	24	2	Purchase		1.78	-	-	1.78	-
S. S. Seal Enclosure Cap	B-651140-47	25	1	Purchase		12.00*	-	-	12.00*	-



Part Nomenclature	Part Number	Item Number	Quantity	Sourcing	Total Material Cost	Total Purchased Parts Cost	Direct Labor Cost	Variable Burden Cost	Total Variable Cost	Vendor Tooling Cost
4orm Drive Power Clamp	52200	26	1	Purchase	\$ .957	\$ .76*	\$ -	\$ -	\$ .76*	\$ -
Upper Stop Collar	A-651140-43	27	1	Make			.32	1.11	2.387	-
Lower Stop Collar	A-651140-48	28	1	Make	3.134		1.87	6.53	11.534	-
Elev. Actuator Nut	B-651140-42	29	1	Purchase		17.09	-	-	17.09	-
3-16 x 3/16 x 1 H. S. Gear Key	10002	30	1	Purchase		.085	-	-	.085	-
3/8 x 3/8 x 1 1/4 S. S. Gear Key	15420	31	1	Purchase		.096	-	-	.096	-
3/64 x 1 Spirol Pin	10500	32	1	Purchase		.036	-	-	.036	-
1/8 Sq. Hd. Pipe Plug	11211	34	4	Purchase		.144	-	-	.144	-
1/4 Sq. Hd. Pipe Plug	11212	35	3	Purchase		.203	-	-	.203	-
Spirol Pin 1/8 x 1	10520	33	2	Purchase		.072	-	-	.072	-
3/8 Sw. Hd. Pipe Plug	11213	36	1	Purchase		.070	-	-	.070	-
Alemite (No. 1610-B1)	13701	37	1	Purchase		.196	-	-	.196	-
Alemite (No. 1625)	13704	38	1	Purchase		.618	-	-	.618	-
Lovejoy Coupling (No. L-070)	100033	39	1	Purchase		3.75	-	-	3.75	-
1/8 x 1/8 x 3/4 Coupling Key	15008	40	1	Purchase		.035	-	-	.035	-
1/4 - 20 x 5/8 Ig. Hex. Hd. Bolt	11874	41	8	Purchase		.080	-	-	.080	-
1/4 - 20 x 7/8 Ig. Hex. Hd. Bolt	11873	42	4	Purchase		.150	-	-	.150	-
1/4 x 20 x 1 Ig. Hex. Hd. Bolt	11875	43	8	Purchase		.315	-	-	.315	-
1/4 - 20 x 1 1/4 Ig. Soc. Hd. Cap Screw	11876	44	4	Purchase		.104	-	-	.104	-
3/8 - 16 x 1 Ig. Hex. Hd. Bolt	11871	45	6	Purchase		.240	-	-	.240	-
5/4 - 16 x 1 1/2 Ig. Nylock Hex. Hd. Bolt	11824	46	1	Purchase		.063	-	-	.063	-
3/4 - 16 x 2 Lg. Nylock Hex. Hd. Bolt	11877	47	1	Purchase		.054	-	-	.054	-
1/4 Lockwasher	13336	48	20	Purchase		.24	-	-	.24	-
3/8 Lockwasher	13337	49	6	Purchase		.096	-	-	.096	-
H. S. Worm	C-651140-29-13	50	1	Purchase		17.61	-	-	17.61	10,000
H. S. Worm Gear	651140-50	51	1	Purchase		8.32	-	-	8.32	5,000
S. S. Worm	651140-41	52	1	Purchase		13.10	-	-	13.10	10,500
S. S. Gear	651140-34	53	1	Purchase		9.96	-	-	9.96	5,000
<b>H-Frame Assembly</b>										
Beam - In. Sup't.	277-10122-5		2	Purchase		126.80	-	-	126.80	125,000
Beam - Out. Sup't.	277-10122-6		2	Purchase		126.80	-	-	126.80	125,000
Reinf. Angle	277-10120-4		8	Make	2.32		.27	.95	3.54	-
Reinf. Angle	277-10120-12		16	Make	5.32		.49	1.70	7.51	-
Reinf. Bar	277-10120-8		4	Make	2.12		2.36	8.27	12.75	-
Strut	277-10120-5		8	Make	9.36		.22	.76	10.34	-
<b>Torque Tube Assembly</b>										
Torque Tube	SK 6130-002		1	Assembly			.58	2.01	2.59	-
Flange - Out.	SK 6130-002-2		1	Make	87.88		.43	1.51	89.82	-
Flange - In.	SK 6130-002-3		2	Make	21.74		1.58	5.54	28.86	30,000
Adapter Ring	SK 6130-002-4		2	Make	21.74		1.15	4.03	26.92	30,000
Adapter Ring	531439-A		2	Make	21.74		1.15	4.03	26.92	30,000





Part Nomenclature	Part Number	Quantity	Sourcing	Total Material Cost	Total Purchased Parts Cost	Direct Labor Cost	Variable Purden Cost	Total Variable Cost	Vendor Tooling Cost
Arm Assembly Torque Tube Act.	531147	1	Assembly			.59	2.08	2.67	-
Arm Actuation	531147-1	2	Make	14.60		.15	.51	15.26	-
Brace Cross	531147-2	2	Make	Det. 1-Offal		.12	.43	.55	-
Brace Cross	531147-3	2	Make	Det. 1-Offal		.12	.43	.55	-
Cap-End	531147-4	1	Make	Det. 1-Offal		.06	.21	.27	-
Torque Tube & Act. Arm Assembly	New-Added	1	Assembly			1.89	6.62	8.51	-
Swivel Ext.-Ring Adapter L. & R.	New-Added	2	Make	24.84		.56	1.97	27.37	13,400
Bracket-Attachment Assembly	277-10119	48	Assembly			.65	2.27	2.92	-
Bracket-Attachment Plate	277-10119-14	8	Make	.48		.57	2.00	3.05	-
Bracket-Attachment Plate	277-10119-13	24	Make	2.40		1.70	5.95	10.05	-
Bracket-Attachment Plate	277-10119-17	16	Make	3.36		1.13	3.96	8.45	-
Doubler-H/U Plate	277-10119-19	48	Make	1.44		1.30	4.55	7.29	-
Attachment-Bracket	277-10119-18	48	Make	21.12		1.78	6.23	29.13	-
Bolt-1/4-20 UNC-2A x 1 1/4 Ig.		12	Purchase		.312	-	-	.312	-
Bolt-1/4-20 UNC-2A x 3/4 Ig.		60	Purchase		1.44	-	-	1.44	-
Nut -1/4-20 UNC		72	Purchase		.936	-	-	.936	-
Washer-1/4 NOM	H Frame	144	Purchase		.202	-	-	.202	-
Bolt-5/16-18 UNC-2A x 1.0 Ig.	Assembly	48	Purchase		1.296	-	-	1.296	-
Bolt-5/16-18 UNC-2A x 1 3/4 Ig.		16	Purchase		.464	-	-	.464	-
Bolt-5/16-18 UNC-2A x 1 1/4 Ig.		32	Purchase		.896	-	-	.896	-
Washer-5/16		192	Purchase		.307	-	-	.307	-
Nut 5/16-18 UNC		96	Purchase		1.92	-	-	1.92	-
Spacer #6 Nylon	277-10119-15	48	Purchase		1.92	-	-	1.92	6,000
Spacer #6 Nylon	277-10119-20	48	Purchase		.96	-	-	.96	6,000
Pad #6 Nylon	277-10119-16	96	Purchase		15.36	-	-	15.36	18,000
Adapter-Elev. Drive Trunnion	531442-01	2	Make	21.40		1.64	5.73	28.77	-
Adapter-Motor Rev. Counter, Az.	531442-02	1	Make	.23*		.14*	.43*	.85*	-
Sleeve -Motor Rev. Counter, Az & El	531442-03	2	Make	1.22*		2.57*	9.00*	12.79*	-
Adapter-Motor Rev. Counter, El.	531442-04	1	Make	.29*		.24*	.86*	1.39*	-
Cover -Motor Rev. Counter, Az & El	531442-05	2	Make	.86*		.73*	2.56*	4.15*	-
Mount-PC Board, Az. & El.	531442-06	2	Make	.14		1.32	4.63	6.09	-
PC Board-M'tr. Rev. Counter, Az & El	531442-07	2	Purchase		22.00	-	-	22.00	-
Adjuster-PC Board, Az. & El.	531442-08	2	Make	.14*		.34*	1.18*	1.66*	-
Magnet Holder-Rev. Counter Az & El	531442-09	2	Purchase		7.00	-	-	7.00	3,000
Mount, Zero Ref., Az.	531442-10	1	Make	.73*		1.03*	3.60*	5.36*	-
Holder, Zero Ref., Az. & El.	531442-11	2	Make	.19*		1.25*	4.37*	5.81*	-
Magnet Holder, Zero Ref. Az. & El.	531442-12	2	Purchase		4.60	-	-	4.60	2,500
Mount, Zero Ref., El.	531442-13	1	Make	.61*		1.86*	6.51*	8.98*	-
Bracket Magnet Holder, Zero Ref. El	531442-14	1	Make	.43*		.68*	2.39*	3.50*	-
Bracket Magnet Holder, Zero Ref. Az	531442-15	1	Make	.22*		.46*	1.61*	2.29*	-
Pin-El., Bearing	531442-16	2	Make	1.02		.46	1.58	3.06	-
Pin-El., Actuator Mount Pivot	531442-17	1	Make	.49		.22	.79	1.50	-



Part Nomenclature	Part Number	Quantity	Sourcing	Total Material Cost	Total Purchased Parts Cost	Direct Labor Cost	Variable Burden Cost	Total Variable Cost	Vendor Tooling Cost
Bracket-Az. Cable Wrap	531442-24	1	Make	\$ 2.97*	\$ -	\$ .79*	\$ 2.77*	\$ 6.53*	\$ -
Gasket	531442-25	2	Purchase	-	.018	-	-	.018	150
Motor-El 1/3 HP	531436-30	1	Purchase	-	82.62	-	-	82.62	864
Motor-Az 1/6 HP	531436-31	1	Purchase	-	66.65	-	-	66.65	-
Retaining Ring	5100-100H	6	Purchase	-	.48	-	-	.48	-
Screw-Cap Hex. Hd. 1/4-20 UNC x 3/4	531436-33	8	Purchase	-	.296	-	-	.296	-
Washer-Flat 1/4	531436-34	19	Purchase	-	.027	-	-	.027	-
Washer-Lock Spring, 1/4	531436-35	19	Purchase	-	.228	-	-	.228	-
Screw-Cap Hex. Hd. 3/8-16 UNC x 7/8	531436-36	10	Purchase	-	.360	-	-	.360	-
Washer-Flat 3/8	531436-37	18	Purchase	-	.029	-	-	.029	-
Washer-Lock Spring 3/8	531436-38	18	Purchase	-	.324	-	-	.324	-
Screw-Cap Hex. Hd. 3/8-16 UNC	531436-39	8	Purchase	-	.352	-	-	.352	-
Nut-Hex 3/8 - 16 UNC	531436-40	8	Purchase	-	.184	-	-	.184	-
Thrust Washer, Cad Plated	G14DU	4	Purchase	-	.048	-	-	.048	-
bushing	GF1620-16	3	Purchase	-	.54	-	-	.54	-
Permatex, Form-A-Gasket No. 2	7472A2	A/R	Purchase	-	.20	-	-	.20	-
Screw-Cap Hex. Hd. 1/4-20 UNC x 7/8	531436-44	8	Purchase	-	.304	-	-	.304	-
Screw-Mach. Pan Hd. #10-32 UNF x 5/8	531436-45	16	Purchase	-	.432	-	-	.432	-
Washer-Flat #10	531436-46	16	Purchase	-	.022	-	-	.022	-
Washer-Lock Spring #10	531436-47	16	Purchase	-	.208	-	-	.208	-
Socket Hd. Screw #10-32 UNF x 1/4	531436-48	2	Purchase	-	.052	-	-	.052	-
Screw-Mach. Pan Hd. #4-40 UNC x 3/8	531436-49	4	Purchase	-	.010	-	-	.010	-
Washer-Flat #4	531436-50	4	Purchase	-	.006	-	-	.006	-
Washer-Lock, Spring #4	531436-51	4	Purchase	-	.044	-	-	.044	-
Nut, Hex. Jam 1/4-28 UNF-2B	531436-52	1	Purchase	-	.04	-	-	.04	-
Retaining Ring-Beryllium Copper	500-18 C	2	Purchase	-	.52	-	-	.52	-
Spring Compression, Stainless Steel	IC-0426-5	2	Purchase	-	.74	-	-	.74	-
Dowel Pin 1/8 Dia. x 1 1/4 lg. S.S.	531436-55	2	Purchase	-	.04	-	-	.04	-
Grommet-Cable Tie	TYG-34M	2	Purchase	-	.10	-	-	.10	-
Screw Cap, Hex Hd 1/4-20 UNC x 1 3/4	531436-57	3	Purchase	-	.078	-	-	.078	-
Nut-Hex. Hd. 1/4-20 UNC	531436-58	3	Purchase	-	.06	-	-	.06	-
Nut-Hex. Jam 3/4-16 UNF 2B	531436-59	4	Purchase	-	.60	-	-	.60	-
Cord Grip	2521	2	Purchase	-	3.52*	-	-	3.52*	-
Cord Grip	2632	2	Purchase	-	5.00*	-	-	5.00*	-
Hall Effect-Digital Switch	5315516	2	Purchase	-	2.00	-	-	2.00	-
Screw Mach. Pan Hd. #4-40 x 1/4	531436-63	2	Purchase	-	.048	-	-	.048	-
Washer-Flat #4	531436-64	2	Purchase	-	.003	-	-	.003	-
Washer-Lock Spring #4	531436-65	2	Purchase	-	.046	-	-	.046	-
Electrical Wiring	531436-82	A/R	Purchase	-	45.00	-	-	45.00	-
Lubricant	531436-83	32	Purchase	-	6.16	-	-	6.16	-
Galvanizing	Various		Make	24.00	-	2.30	8.06	34.36	-
Heat Treatment	Various		Make	-	-	2.30	8.06	10.36	-
Paint	Various		Make	5.97*	-	3.46*	12.12*	21.55*	-
Tear Down and Repair	Various		Make	-	-	5.87	20.55	26.42	-
<b>TOTALS:</b>				<u>\$767.25*</u>	<u>\$813.99*</u>	<u>\$102.66*</u>	<u>\$359.48*</u>	<u>\$2,042.78*</u>	<u>\$579.06</u>

\* Cost shown prior to adjustment.





Heliostat Manufacturing Study

VARIABLE COST DETAIL

50,000 UNITS PER YEAR

II - FINAL FIELD ASSEMBLY PLANT  
ON UTILITY SITES

<u>Part Nomenclature</u>	<u>Part Number</u>	<u>Quantity</u>	<u>Sourcing</u>	<u>Total Material Cost</u>	<u>Total Purchased Parts Cost</u>	<u>Direct Labor Cost</u>	<u>Variable Burden Cost</u>	<u>Total Variable Cost</u>	<u>Vendor Tooling Cost</u>
Heliostat Assy. (On Site & Install.)	277-10115	1	Assembly	\$ -	\$ -	\$37.252	\$74.504	\$111.756	\$ -
<b>TOTAL:</b>						<u>\$37.25</u>	<u>\$74.50</u>	<u>\$111.75</u>	

## Heliostat Manufacturing Study

WORK STANDARDS

50,000 UNITS PER YEAR

I - MANUFACTURING PLANT

<u>Part Name</u>	<u>Part Number</u>	<u>Quantity</u>	<u>Standard Minutes Per Piece</u>	<u>Standard Minutes Per Unit</u>
<u>Azimuth Drive Assembly</u>	651133-18	1	45.20	45.20
Worm Gear Housing	790234	1	16.63	16.63
H.S. Cap	800240	1	9.78	9.78
S.S. Cover	800241	1	7.37	7.37
S.S. Shaft	830234AB	1	22.13	22.13
S.S. Shaft Spacer-Short	835235	1	1.72	1.72
S.S. Shaft Spacer-Long	855236	1	1.76	1.76
H.S. Housing Bushing	855234	1	2.17	2.17
Base Housing	926610	1	6.33	6.33
Cover-Housing	926220	1	10.40	10.40
Planet Gear	936140	3	9.60	28.80
Planetary Frame	926310	1	4.32	4.32
Primary Ring Gear	936710	1	17.94	17.94
Secondary Ring Gear	936440	1	17.72	17.72
Friction Ring	926360	6	.31	1.86
Journal Pin	926361	3	2.22	6.66
Ball Retaining Bolt	926913	1	.86	.86
<u>Elevation Drive Assembly</u>	D651140-18A	1	-	24.30
Housing	D651140-22	1	23.76	23.76
Attachment Housing	C651140-46	1	13.17	13.17
Attach. Housing Cover	A5510-L	1	0.39	0.39
Inter Cover	4485	1	2.27	2.27
S.S. Cover	B-651140-20	1	5.03	5.03
H.S. Cap Open	A651140-45A	1	4.42	4.42
Motor Adapter	7922	1	6.59	6.59
S.S. Shaft	B651140-23	1	16.55	16.55
S.S. Spacer	A651140-21A	1	1.77	1.77
S.S. Shaft Spacer Washer	A651140-44A	1	1.45	1.45
S.S. Seal Enclosure Cap	B651140-47	1	0.83	0.83
Upper Stop Collar	A651140-43	1	1.88	1.88
Lower Stop Collar	A651140-48	1	11.06	11.06
<u>Gimbal Housing</u>	531146	1	8.26	8.26



<u>Part Name</u>	<u>Part Number</u>	<u>Quantity</u>	<u>Standard Minutes Per Piece</u>	<u>Standard Minutes Per Unit</u>
<u>H-Frame Assembly</u>				
Reinf. Angle	277-10122-4	8	.20	1.60
Reinf. Angle	277-10122-12	16	.18	2.88
Reinf. Bar	277-10122-8	4	3.50	14.00
Strut	277-10122-5	8	.16	1.28
<u>Torque Tube Assembly</u>				
Torque Tube	SK-6130-002	1	3.41	3.41
Flange-Outboard	SK-6130-002-2	1	2.56	2.56
Flange-Inboard	SK-6130-002-3	2	4.69	9.38
Adapter Ring	SK-6130-002-4	2	3.41	6.82
Arm Assy.-Torque Tube Act.	531439-A	2	3.41	6.82
Arm Actuation	531147	1	3.52	3.52
Brace-Cross	531147-1	2	0.43	0.86
Brace-Cross	531147-2	2	0.36	0.72
Brace-Cross	531147-3	2	0.36	0.72
Cap-End	531147-4	1	0.36	0.36
<u>Torque Tube &amp; Act. Arm Assembly</u>				
Swivel Ext.-Ring Adapt.	(New added)	1	11.20	11.20
Assy. Attach. Brkt.	(New added)	2	3.34	6.68
Bracket-Attach. Plate		48	.08	3.84
" " "	277-10119-14	8	0.42	3.36
" " "	277-10119-13	24	0.42	10.08
" " "	277-10119-17	16	0.42	6.72
Doubler B/U Plate	277-10119-19	48	0.16	7.68
Attachment-Bracket	277-10119-18	48	0.22	10.56
Adapter-El. Dr. Trunnion	531442-01	2	4.85	9.70
Adapter-Motor Rev. Cntr.-Az.	531442-02	1	0.81	0.81
Sleeve-Motor Rev. Cntr., Az. & El.	531442-03	2	7.62	15.24
Adapter-Motor Rev. Cntr., El.	531442-04	1	1.45	1.45
Cover-Motor Rev. Cntr., Az. & El.	531442-05	2	2.17	4.34
Mount-PC Board, Az. & El.	531442-06	2	3.92	7.84
Adjuster-PC Board, Az. & El.	531442-08	2	1.00	2.00
Mount-Zero Ref., Az.	531442-10	1	6.10	6.10
Holder-Zero Ref., Az. & El.	531442-11	2	3.70	7.40
Mount Zero Ref.-El.	531442-13	1	11.02	11.02
Bracket Magnet Hldr-El.	531442-14	1	4.05	4.05
Bracket Magnet Hldr-Az.	531442-15	1	2.73	2.73
Pin-El. Bearing	531442-16	2	1.34	2.68
Pin-El. Act. Mount Pivot	531442-17	1	1.33	1.33
Bracket-Az. Cable Wrap	531442-24	1	4.69	4.69
Galvanize Dept. (2 men/shift)			13.65	13.65
Heat Treat Dept. (2 men/shift)			13.65	13.65
Paint System			19.50	19.50
Teardown & Repair			34.80	34.80
Subtotal Manufacturing Plant			-	601.41



II - FINAL FIELD ASSEMBLY PLANT  
ON UTILITY SITE

<u>Part Name</u>	<u>Part Number</u>	<u>Quantity</u>	<u>Standard Minutes Per Piece</u>	<u>Standard Minutes Per Unit</u>
<u>Heliostat Final Assembly and Install.</u>				220.75
Subtotal Final Field Assy. Plant				<u>220.75</u>
TOTAL STANDARD MINUTES				<u><u>822.16</u></u>



Section 6.5

Heliostat Manufacturing Study

Manufacturing Plant

MANPOWER REQUIREMENTS - SUMMARY

	<u>Total Headcount</u>				<u>Direct Labor</u>			<u>Indirect Hourly</u>				<u>Salary</u>			
	<u>Shift</u>				<u>Shift</u>			<u>Shift</u>				<u>Shift</u>			
	<u>2</u>	<u>3</u>	<u>1</u>	<u>Total</u>	<u>2</u>	<u>3</u>	<u>Total</u>	<u>2</u>	<u>3</u>	<u>1</u>	<u>Total</u>	<u>2</u>	<u>3</u>	<u>1</u>	<u>Total</u>
Plant Manager's Office	2	2	-	4	-	-	-	-	-	-	-	2	2	-	4
Production Department	215	214	-	429	185	185	370	13	13	-	26	17	16	-	33
Manufacturing Engineering	35	15	-	50	-	-	-	16	12	-	28	19	3	-	22
Plant Engineering	65	42	19	126	-	-	-	50	36	17	103	15	6	2	23
Quality Control	55	49	-	104	-	-	-	40	39	-	79	15	10	-	25
Supply Operations	54	33	-	87	-	-	-	34	28	-	62	20	5	-	25
Industrial Relations	32	16	11	59	-	-	-	17	11	9	37	15	5	2	22
Controller's Office	<u>30</u>	<u>1</u>	<u>-</u>	<u>31</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>-</u>	<u>30</u>	<u>1</u>	<u>-</u>	<u>31</u>
Totals	488	372	30	890	185	185	370	170	139	26	335	133	48	4	185

Shift 1 = 12 AM to 8 AM  
 Shift 2 = 8 AM to 4 PM  
 Shift 3 = 4 PM to 12 AM

Heliostat Manufacturing Study

Manufacturing Plant

MANPOWER REQUIREMENTS - INDIRECT HOURLY

	Indirect Hourly Headcount	Distribution by Shift			Distribution by Skill		
		#2	#3	#1	Skilled	Semi-Skilled	Un-Skilled
<u>Production Department</u>							
Job Setters	14	7	7		14		
System Attendants for Galvanizing, Paint, Heat Treat	6	3	3		6		
Transfers, Dolly & Fixture Hndl. etc.	6	3	3			6	
Total	26	13	13		20		6
<u>Manufacturing Engineering</u>							
Toolmakers	24	14	10		24		
Tool Control Records	4	2	2			4	
Total	28	16	12		24		4
<u>Plant Engineer</u>							
Machine Repair	35	15	14	6	35		
Electricians	10	5	3	2	10		
Pipe Fitters	3	2	1		3		
Carpenters	3	2	1		3		
Oilers & Prev. Maint.	4	2	1	1		4	
Indust. Truck & Vehicle Maint.	5	3	2		5		
Machine Cleaner	4	2	1	1			4
Paint Equipment Cleaners	3			3			3
Office Clean Up	4		4				4
Grounds Maint.	11	9	2			2	9
Janitors	21	10	7	4			21
Total	103	50	36	17	56	6	41
<u>Quality Control</u>							
Laboratory Testing	9	5	4		5	4	
Gear Testing	10	5	5			10	
Receiving Inspection	4	2	2			4	
Machining Inspection	44	22	22			44	
Assembly Inspection	6	3	3			6	
Functional Inspection	4	2	2			4	
Surveillance Inspection	2	1	1			2	
(Galvanizing, Paint, Etc.)							
Total	79	40	39		5	74	

	Indirect Hourly Headcount	Distribution by Shift			Distribution by Skill		
		#2	#3	#1	Skilled	Semi-Skilled	Un-Skilled
<u>Supply Operations</u>							
Material Handling & Line Feed	22	11	11		4	18	
Fork Lift, Tug & Truck Drivers	21	11	10		21		
Receiving Checkers	3	3			3		
Packing & Shipping	8	5	3			8	
Tool Crib Attendants	4	2	2		4		
Non-Production Materials	4	2	2			4	
Total	<u>62</u>	<u>34</u>	<u>28</u>		<u>24</u>	<u>38</u>	
<u>Industrial Relations</u>							
Safety & Plant Protection	32	13	10	9	32		
General Services	5	4	1		5		
Total	<u>37</u>	<u>17</u>	<u>11</u>	<u>9</u>	<u>37</u>		

Heliostat Manufacturing Study

Manufacturing Plant

MANPOWER REQUIREMENTS - SALARY

	<u>Salaried Headcount</u>	<u>#2 Shift</u>	<u>#3 Shift</u>	<u>#1 Shift</u>
<u>Plant Manager's Office</u>				
Plant Manager	1	1		
Secretary	1	1		
Assistant Plant Manager	1		1	
Secretary	<u>1</u>		<u>1</u>	
Total	4	2	2	
<u>Production Department</u>				
Production Manager	2	1	1	
General Foremen	6	3	3	
Foremen	22	11	11	
Clerical	<u>3</u>	<u>2</u>	<u>1</u>	
Total	33	17	16	
<u>Manufacturing Engineering Department</u>				
Manager	1	1		
Clerical/Typist	1	1		
Process Eng. Supervisor	1	1		
Process Eng.-Mach.	3	2	1	
Process Eng.-Assembly & Other	2	2		
Tool Control Analyst	2	2		
Fixture & Tool Designer	1	1		
Industrial Eng. Supervisor	1	1		
Industrial Eng.-Dir. Lab.	3	2	1	
Industrial Eng.-Ind. Lab.	2	2		
Indirect Material Stds.	1	1		
Material Hndlg. Engineer	1	1		
Layout Engineer	1	1		
Tool Room & Cutter Grind	2	1	1	
Shop Supervisor	—	—	—	
Total Manufacturing Eng.	22	19	3	



	<u>Salaried Headcount</u>	<u>#2 Shift</u>	<u>#3 Shift</u>	<u>#1 Shift</u>
<u>Plant Engineering Department</u>				
Manager	1	1		
Clerical/Typist	1	1		
Equipment Engineer-Electrical	1	1		
Equipment Engineer-Mechanical	1	1		
Equipment Engineer-Hydraulic	1	1		
Mach. & Equip. Maint.-Supt.	2	1	1	
-Foreman	6	3	2	1
General Services -Supt.	2	1	1	
-Foreman	5	2	2	1
Preventative Maint. Programmer	1	1		
Design & Project Engineer	1	1		
Plant Eng. Records Clerk	<u>1</u>	<u>1</u>		
Total	<u>23</u>	<u>15</u>	<u>6</u>	<u>2</u>

<u>Quality Control</u>				
Manager	1	1		
Clerical/Typist	1	1		
Laboratory Supervisor	2	1	1	
Gear Test Supervisor	2	1	1	
Laboratory Technicians	4	2	2	
Metalurgist	1	1		
Chemist	1	1		
Evaluation Engineers	2	1	1	
Defective Matl's Coord.	1	1		
In Process Inspection:				
Gen'l. Foreman	2	1	1	
Foreman	<u>8</u>	<u>4</u>	<u>4</u>	
Total	<u>25</u>	<u>15</u>	<u>10</u>	

<u>Supply Operations</u>				
Manager	1	1		
Secretary	1	1		
Material Control Supervisor	1	1		
Inventory & Parts Control Analyst	4	4		
Non-Prod. Stores & Tool Crib Supv.	2	1	1	
Purchasing & Traffic Supv.	1	1		
Purchasing Analyst	2	2		
Non-Prod. Matl's.	1	1		
Traffic Coordinator	1	1		

	<u>Salaried Headcount</u>	<u>#2 Shift</u>	<u>#3 Shift</u>	<u>#1 Shift</u>
<u>Supply Operations-continued</u>				
Material Handling Gen'l. Foreman	2	1	1	
Transportation Foreman	2	1	1	
Material Handling & Line Feed Foremen	4	2	2	
Receiving & Shipping Supv.	1	1		
Clerical Records & Dispatch	2	2		
Total	<u>25</u>	<u>20</u>	<u>5</u>	
<u>Industrial Relations</u>				
Manager	1	1		
Clerical/Typist	1	1		
Safety & Plant Protection	7	4	2	1
Hourly Employee & Labor Relations	6	4	1	1
Salaried Personnel	3	3		
Personnel Services	4	2	2	
Total	<u>22</u>	<u>15</u>	<u>5</u>	<u>2</u>
<u>Controller's Office</u>				
Controller	1	1		
Secretary	1	1		
Cost Accounting	7	7		
Payroll & Time Keeping	8	7	1	
Systems & Data Processing	6	6		
General Accounting	8	8		
Total	<u>31</u>	<u>30</u>	<u>1</u>	

Heliostat Manufacturing Study

FIELD ASSEMBLY & INSTALLATION - SINGLE LOCATION

Manpower Requirements

Ford Aerospace & Communications Corporation



	<u>Total Headcount</u>			<u>Direct Labor</u>			<u>Indirect Hourly</u>			<u>Salary</u>		
	<u>Shift</u>		<u>Total</u>	<u>Shift</u>		<u>Total</u>	<u>Shift</u>		<u>Total</u>	<u>Shift</u>		<u>Total</u>
	<u>2</u>	<u>3</u>		<u>2</u>	<u>3</u>		<u>2</u>	<u>3</u>		<u>2</u>	<u>3</u>	
Field Operations Manager										1		1
Assistant Operations Manager											1	1
Production Foreman - Assembly										2	2	4
Production Foreman - Installation										1		1
General Supervisor (Inspection Equipment Maint. -Materials)										1	1	2
Material Control Analyst										1		1
Timekeeping & Clerical Records										2	1	3
Production Operators - Assembly				36	36	72						
Production Operators - Installation				7		7						
Fork Lift & Tow Truck Drivers - Assembly							4	4	8			
Fork Lift & Tow Truck Drivers - Install							4		4			
Receiving & Stock Checkers							2	2	4			
Stock Handling & Line Feed							3	3	6			
Tool Crib Attendants							1	1	2			
Facility & Equipment Maintenance							2	2	4			
Cleaning & Trash Disposal							2	2	4			
Inspection							2	2	4			
Totals	71	57	128	43	36	79	20	16	36	8	5	13

Ford Motor Company



Section 7.0

Heliostat Manufacturing Study

INVESTMENT COSTS

- Section 7.1            Investment Summary
- Section 7.2            Investment Detail for Machinery, Equipment and  
Tooling
- Section 7.3            Summary of Vendor Tooling Costs for Purchased  
Finished Parts.

Itemized costs of land, site improvements, buildings, and building equipment are presented in Section 8, Facilities.



## Section 7.1

## Heliostat Manufacturing Study

INVESTMENT SUMMARY  
((\$000))

	<u>Manufacturing Plant</u>	<u>Field Assembly Plant on Utility Sites</u>
Land	\$ 1,250	
Site Improvements	2,100	
Building & Building Equipment	<u>16,650</u>	\$ 1,500 *
Sub-Total Land & Building	\$20,000	\$ 1,500 *
Process Machines & Support Equipment	\$44,100	\$ 2,036 **
Sub-Total Facilities	<span style="border: 1px solid black; padding: 2px;">\$64,100</span>	<span style="border: 1px solid black; padding: 2px;">\$ 3,536</span>
Tooling & Gages	\$ 7,190	\$ 390 **
Vendor Tooling	580	
Sub-Total Tooling	<span style="border: 1px solid black; padding: 2px;">\$ 7,770</span>	<span style="border: 1px solid black; padding: 2px;">\$ 390</span>
Program Engineering	\$ 5,100	***
Training, Pre-activation & Launch	13,575	780 **
Sub-Total Engineering & Launch	<span style="border: 1px solid black; padding: 2px;">\$18,675</span>	<span style="border: 1px solid black; padding: 2px;">\$ 780</span>
<b>TOTALS</b>	<span style="border: 1px solid black; padding: 2px;"><u>\$90,545</u></span>	<span style="border: 1px solid black; padding: 2px;"><u>\$ 4,706</u></span>
<b>GRAND TOTAL</b>		<span style="border: 1px solid black; padding: 2px;"><u>\$95,251</u></span>

\* Based on \$500 each for first three sites; each additional site will require \$400 (see building description, Section 8.1).

\*\* Based on two sets - to be moved to other sites as required (see Manufacturing Plan, Section 5, for description).

\*\*\* Included in Manufacturing Plant.



## Section 7.2

Heliostat Manufacturing Study  
MACHINERY, EQUIPMENT AND TOOLING INVESTMENT DETAIL  
 50,000 UNITS 1 YEAR

	Part Number	Quantity Required Per Unit	Process Machinery (000)	Tools & Gauges (000)	Production Support Equipment (000)	Total (000)	Remarks	
<b>I - MANUFACTURING PLANT</b>								
<u>Gimbal/Azimuth/Bearing Drive Assembly</u>								
	D-651133-18	1	\$ 0	\$ 354.0	\$ 175.0	\$ 529.0		
	Worm Gear Housing	1	929.1	306.0	207.7	1,442.8		
	H. S. Cap	1	800240	215.8	38.5	396.3		
	S. S. Cover	1	800241	211.5	74.0	359.5		
	S. S. Shaft Spacer-Short	1	835235	0	8.0	8.0		
	S. S. Shaft Spacer-Long	1	834236	0	10.0	10.0		
	H. S. Housing Bushing	1	835234	90.7	18.0	158.4		
	Base Housing	1	926610	713.0	145.0	1,042.0		
	Cover - Housing	1	926220	747.0	237.0	1,235.0		
	Planet Gear	3	936140	3,183.0	438.5	4,172.5		
	Planetary Frame	1	926310	706.0	384.5	1,237.5		
	Primary Ring Gear	1	935710	2,134.0	605.2	3,101.2		
	Secondary Ring Gear	1	936440	1,958.0	988.0	3,413.0		
	Friction Ring	6	926360	19.5	12.5	52.7		
	Journal Pin	3	926361	11.3	11.0	28.8		
	Ball Retaining Bolt	1	926913	9.2	3.0	17.2		
	Gimbal Housing	1	531146	733.0	210.0	1,158.0		
<u>Elevation Drive Assembly</u>								
	D651140-18A	1	0	59.0	45.5	104.5		
	Housing	1	D651140-22	1,607.0	665.0	2,506.0		
	Attachment Housing	1	C651140-46	855.0	339.0	1,371.0		
	Attachment Housing Cover	1	A5510-L	55.0	16.5	99.0		
	Inter Cover - H.S. Cap Closed	1	4485	98.5	28.0	151.5		
	S. S. Cover	1	B651140-20	99.0	32.5	150.5		
	H. S. Cap Open	1	A651140-45A	171.0	50.0	239.5		
	Motor Adapter	1	7922	132.5	67.0	250.0		
	S. S. Spacer	1	A651140-21A	72.0	42.0	131.5		
	S. S. Shaft Spacer Washer	1	A651140-44A	71.0	18.0	125.5		
	Upper Stop Collar	1	A651140-43	73.0	10.0	124.5		
	Lower Stop Collar	1	A651140-48	90.1	35.5	123.1		
	S. S. Shaft	1	B651140-23	10,385.0	662.0	11,712.0		
<u>Torque Tube Assembly</u>								
	SK-6130-002	1	34.7	164.4	*	199.1		
	Torque Tube	1	SK-6130-002-2	721.0	133.0	*	854.0	
	Flange-Outboard	2	SK-6130-002-3	133.6	91.6	*	225.2	
	Flange-Inboard	2	SK-6130-002-	0	0	0		
	Adapter Ring	2	431439A	401.7	15.9	*	417.6	Included in Flange-Outboard
<u>Arm Assembly Torque Tube Act.</u>								
	531147	1	21.9	20.6	*	42.5		
	Arm Actuation	2	531147-1	311.6	122.9	*	434.5	
	Brace-Cross	2	531147-2	0	11.0	*	11.0	
	Brace-Cross	2	531147-3	0	5.8	*	5.8	
	Cap-End	1	531147-4	35.9	9.4	*	45.3	

\*Included under Press Shop General

Ford Aerospace & Communications Corporation

Ford Motor Company

HelioStat Manufacturing Study  
MACHINERY, EQUIPMENT AND TOOLING INVESTMENT DETAIL  
 50,000 UNITS 1 YEAR

Ford  
 Ford Aerospace &  
 Communications Corporation

	Part Number	Quantity Required Per Unit	Process Machinery (000)	Tools & Gauges (000)	Production Support Equipment (000)	Total (000)	Remarks
Torque Tube & Act. Arm Assembly	(new added)	1	\$ 4.5	\$ 45.5	\$ *	\$ 50.0	
Swivel Ext.-Ring Adapter	(new added)	2	562.0	292.0	87.0	941.0	
<u>H-Frame Assembly</u>	277-1020	2	-	-	-	-	Included in HelioStat Ass'y on Utility Sites
Reinf. Angle	277-1020-4	8		5.4	*	5.4	
Reinf. Angle	277-1020-12	16	46.1	4.3	*	50.4	
Reinf. Bar	277-1020-8	4	172.5	6.8	*	179.3	
Strut	277-1020-5	8	56.0	2.4	*	58.4	
Assembly Attach. Brkt.	277-10119	48	119.0	82.0	*	201.0	
Bracket Attach. Plate	277-10119-14	24	80.0	6.4	*	86.4	
Bracket Attach. Plate	277-10119-13	8	83.1	7.0	*	90.1	
Bracket Attach. Plate	277-10119-17	16	115.9	20.7	*	136.6	
Attachment-Bracket	277-10119-18	48	220.7	34.2	*	254.9	
Doubler B/U Plate	277-10119-19	48	41.1	4.4	*	45.5	
Adapter-El. Dr. Trunnion	531442-01	2	405.0	83.4	101.0	589.4	
Adapter-Motor Rev. Cntr.-Az.	531442-02	1	73.9	3.2	*	77.1	
Sleeve-Motor Rev. Cntr.-Az. & El.	531442-03	2	199.5	47.0	125.2	371.7	
Adapter-Motor Rev. Cntr.-El.	531442-04	1	0	4.8	*	4.8	
Cover-Motor Rev. Cntr.-Az. & El.	531442-05	2	0	4.3	*	4.3	
Mount-PC Board -Az. & El.	531442-06	2	34.3	5.3	*	39.6	
Adjuster-PC Board-Az. & El.	531442-08	2	9.2	1.2	2.5	12.9	
Magnet Holder-Rev. Cntr.-Az. & El.	531442-09	2	28.4	9.6	61.0	99.0	
Mount-Zero Ref., Az.	531442-10	1	0	1.5	*	1.5	
Holder-Zero Ref., Az.	531442-11	2	66.9	2.4	33.8	103.1	
Magnet Holder-Zero Ref. Az. & El.	531442-12	2	0	1.7	0	1.7	
Mount-Zero Ref.-El.	531442-13	1	87.3	13.2	0	100.5	
Bracket Magnet Holder-El.	531442-14	1	3.1	6.7	*	9.8	
Bracket Magnet Holder-Az.	531442-15	1	208.9	9.5	*	218.4	
Pin-El. Bearing	531442-16	2	77.1	23.0	38.0	138.1	
Pin-El. Act. Mount Pivot	531442-17	1	0	10.0	0	10.0	
Bracket-Az. Cable Wrap	531442-24	1	24.6	8.7	*	33.3	
Tool Room					1,767.2	1,767.2	
Cutter Grind					1,233.2	1,233.2	
Maintenance					1,340.0	1,340.0	
Quality Control Layout & Lab's					1,719.7	1,719.7	
Washing-Cleaning Equipment					449.9	449.9	
Heat Treat General					408.3	408.3	
Press Shop General					592.0	592.0	
Galvanizing System					1,250.0	1,250.0	
Paint System					330.0	330.0	
Material Handling					506.0	506.0	
<b>Sub-Total - Manufacturing Plant</b>			<b>\$29,749.7</b>	<b>\$7,188.9</b>	<b>\$14,347.4</b>	<b>\$51,286.0</b>	

\*Included under Press Shop General

Ford  
 Ford Motor Company



Heliostat Manufacturing Study  
MACHINERY, EQUIPMENT AND TOOLING INVESTMENT DETAIL  
 50,000 UNITS 1 YEAR

	<u>Part Number</u>	<u>Quantity Required Per Unit</u>	<u>Process Machinery (000)</u>	<u>Tools &amp; Gauges (000)</u>	<u>Production Support Equipment (000)</u>	<u>Total (000)</u>	<u>Remarks</u>
<u>II - ON UTILITY SITES</u>							
Heliostat Assembly & Mounting	777-10115	1	\$ -	\$ 390.0	\$ 50.0	\$ 440.0	{ (2) Complete Sets Assuming { (2) Sites Working Simultaneously
Material Handling			-	-	1,986.0	1,986.0	
Sub-Total - Utility Sites			-	\$ 390.0	\$2,036.0	\$ 2,426.0	
Grand Total - Manufacturing Plant & Utility Sites			\$29,749.7	\$7,578.9	\$16,383.4	\$53,712.0	



Heliostat Manufacturing Study  
SUMMARY OF VENDOR TOOLING COSTS

50,000 Units Per Year

Gimabal and Azimuth Drive/Bearing Assembly	\$100,598
Elevation Drive Assembly	88,550
Reflector Panel H-Frame Assemblies	250,000
Reflector Panel Attachment Brackets	30,000
Torque Tube Assembly	90,000
Arm Assembly	13,400
Subtotal	<u>\$572,548</u>
Motors	864
Sensors and Attachments	5,650
Total	<u>\$579,062</u>

Section 8.0

Heliostat Manufacturing Study

FACILITIES

Section 8.1 Building Description including costs.

Section 8.2 Site Plan, Itemized Plant Areas and Block Plant Layout

## HELIOSTAT MANUFACTURING STUDY

BUILDING DESCRIPTION1. Site

The developed manufacturing facilities having a total floor area of 282,300 square feet require a building site of 50 acres. This land area includes adequate space for future building expansion. The site, located near Phoenix, Arizona, is assumed to be developed for direct or nearby services to satisfy all utility and transportation requirements for the proposed new plant.

2. Manufacturing Building

The manufacturing building will have a floor area of 240,000 square feet, constructed with a structural steel framing system, concrete or masonry sill walls, continuous aluminum sash, metal siding to eave, reinforced concrete floor and insulated roof on metal decking. The bay sizes are 50'-0" x 50'-0" with a clear truss height of 18'-0" in the general area and 30'-0" in the high bay area. The building is equipped with all necessary mechanical and electrical services and equipment for the intended manufacturing operations. A complete fire protection system (sprinklers) is included. Air conditioning is not provided, but an alternate cost for an air conditioning system was developed.

3. Galvanizing Building

This building will be a laminated wood structure, 210'-0" x 60'-0" wide, having a clear height of 25'-0", finished with wood walls and roof deck to prevent corrosion. The estimated costs for the special galvanizing equipment and for the galvanizing waste treatment system are included in the manufacturing process costs.

4. Employee Facilities

These facilities will be housed in a single story separate building, adjacent to the manufacturing building and connected to the administration building.

It will include the following areas:

Locker Room	* Hourly Cafeteria
Shower Room	* Salary Cafeteria
Toilet Room	* Executive Dining Room
Washroom	* Medical Area
*Kitchen	* Training Area

\* = air conditioned areas



5. Administration Building

This building is a single story structure with a clear ceiling height of 10'-0". Areas within the administration building include the executive offices and general offices as well as toilet facilities for office personnel. Central air conditioning will be provided throughout the administration building.

6. Construction Areas

<u>Building</u>	<u>Square Feet</u>
. Manufacturing	240,000
. Galvanizing	12,600
. Administration	14,000
. Employee Facilities	12,000
. Utility	2,000
. Oil and Paint Storage	800
. Waste Treatment	600
. Guard Houses (two)	300
	<hr/>
Total	282,300

7. Estimated Construction Cost (Current Economics)

. Land (50 acres @ \$25,000/acre)	\$ 1,250,000
. Site Improvements	2,100,000
. Manufacturing Building	10,100,000
. Galvanizing Building	750,000
. Utility Building	200,000
. Oil & Paint Storage	25,000
. Guard Houses	25,000
. Industrial Waste Treatment (200,000 gal. storage capacity)	1,250,000
. Administration Building	1,200,000
. Employee Facilities Building	750,000



7. <u>Estimated Construction Cost (Current Economics)</u>	(Continued)
. Furniture, Kitchen, Lockers, Etc.	\$ 600,000
. Master Substation (15,000 KVA)	<u>650,000</u>
Subtotal Construction	\$ 18,900,000
. Architect - Engineer Fees, Tests and Permits	<u>1,100,000</u>
Grand Total	\$ 20,000,000

Alternate Cost to Air Condition Manufacturing Building:  
Add \$ 900,000

8. Final Field Assembly Plant (On Utility Sites)

- . Each required "field assembly building" comprising 12,500 sq. ft. will be a pre-engineered structure, including hoists, conveyor and all necessary mechanical and electrical systems.

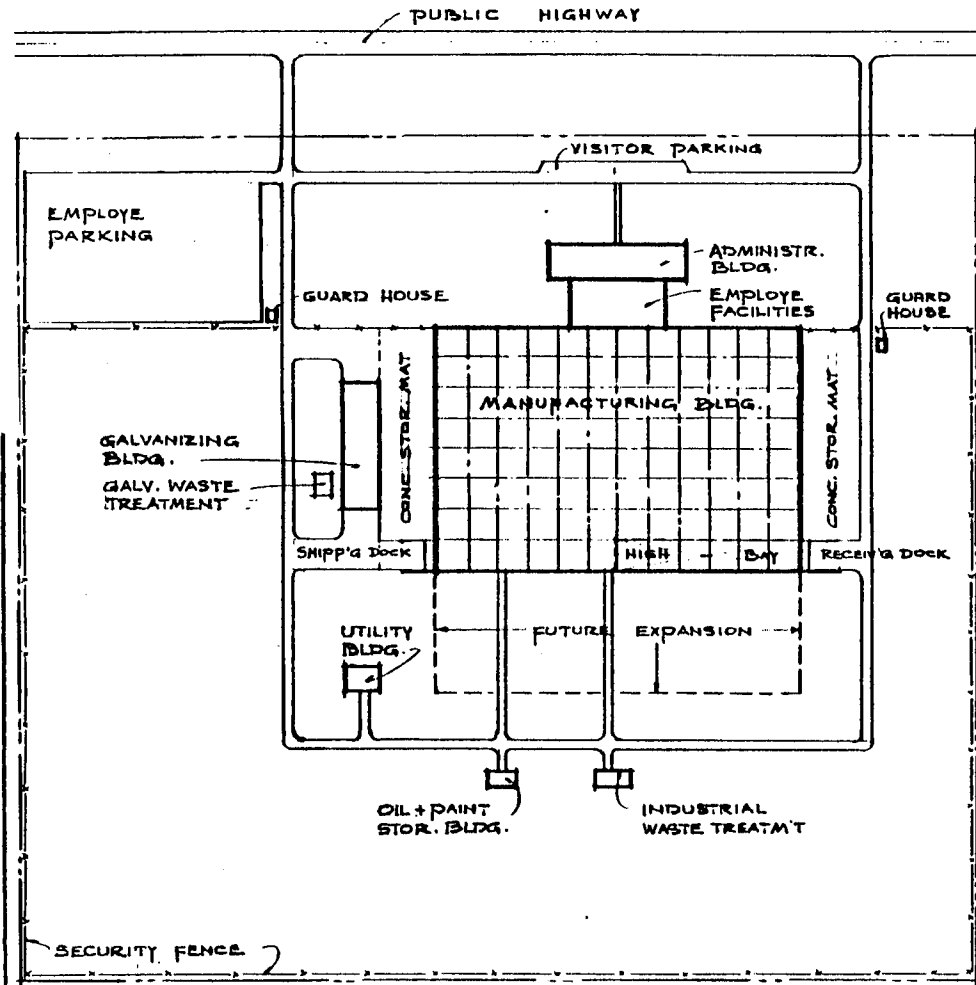
Estimated Cost (each building): \$500,000

- . Dismantle "field assembly building", except for one 50x50 ft. bay to remain on site for maintenance purposes.

Build new foundations, floor slab, extra 50x50 ft. bay  
and re-erect building and equipment on new site: \$400,000

Section 8.2

Ford  
Ford Aerospace &  
Communications Corporation



PROPOSED HELIOSTAT  
MANUFACTURING FACILITY  
50,000 ANNUAL VOLUME

SITE PLAN  
SCALE = 1" = 200'0"

SITE AREA = 50 ACRES

ASSUMED  
NORTH

FMEA, MANUFACTURING PLANS  
9-30-80 E.L.K.

Ford Motor Company

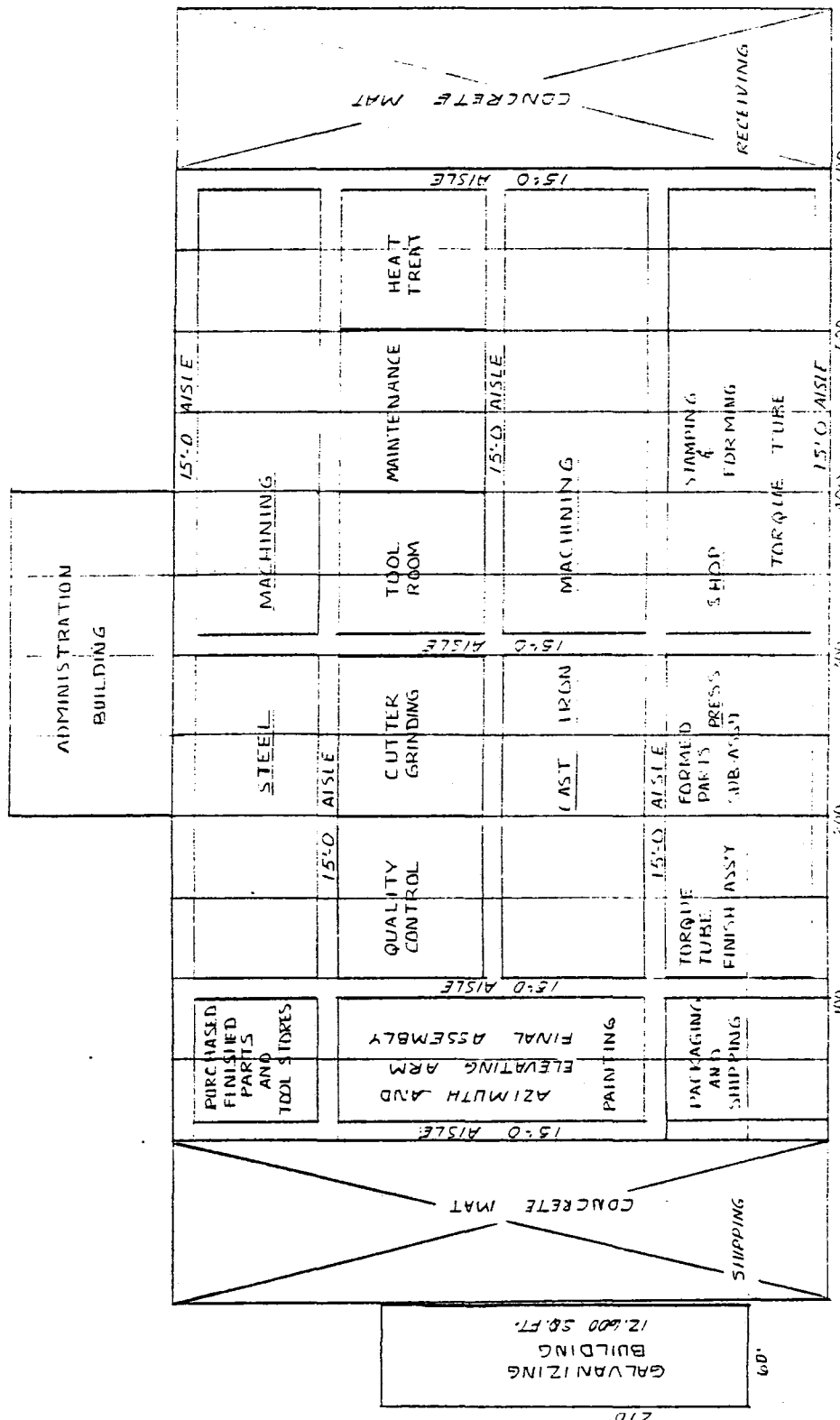


## Heliostat Manufacturing Study

MANUFACTURING PLANT AREAS  
(Square Feet)

Purchase Parts and General Stores	4,900	
Packaging and Shipping	7,000	
Quality Control	8,500	
Cutter Grinder	8,500	
Tool Room	7,225	
Maintenance	<u>8,500</u>	
Subtotal Non-Production Areas		44,625
Heat Treat	7,225	
Steel Machining	32,900	
Cast Iron Machining	39,950	
Press Shop	39,950	
Final Assembly and Painting	<u>12,950</u>	
Subtotal Manufacturing and Assembly		132,975
Main Aisles	<u>62,400</u>	<u>62,400</u>
Total Manufacturing Building		240,000
Galvanizing Building		12,600
Concrete Mat Area		80,000
- Shipping, Receiving, Storage and Marshalling		

PROPOSED HELIOSTAT  
MANUFACTURING FACILITY  
50000 ANNUAL VOLUME



BUILDING SIZE: 400' X 600'  
240,000 SQUARE FEET  
SCALE: 1/4" = 50'-0"



Section 9.0

Heliostat Manufacturing Study

PROGRAM ENGINEERING

Program Engineering is defined as the necessary organization to refine this cost study working with production type released product drawings and specifications. The work would start with reviewing the released design information and determining a finalized make/buy plan, and continue until all facilities and tooling have been approved for shipment at the vendor's plants, all part suppliers have been validated and an organization has been established for plant start-up.

Estimated calendarized man/months by classification and costs are shown on the attached sheet.

Heliostat Manufacturing Study

PROGRAM ENGINEERING  
(Man Months)

  
 Ford Aerospace &  
 Communications Corporation

	1981 (Quarters)				1982 (Quarters)				1983 (Quarters)				Total Program	
	Contract					1st	2nd	3rd	4th	1st	2nd	3rd		4th
	1st	Award	2nd	3rd	4th									
Program Manager's Office	6		6	6	6	6	6	6	6	6	6	6	6	72
Manufacturing Engineering Mgr.	3		3	3	3	3	3	3	3	3	3	3	3	36
Senior Process Engineer	-		3	3	3	3	3	3	3	3	3	3	3	33
Process Engineer	-		3	6	12	15	18	21	24	21	18	15	12	165
Fixture, Gauge, Tool & Die Design Engineer	-		-	6	6	9	9	12	12	3	3	3	-	63
Equipment Engineer	-		-	6	9	12	12	12	12	6	3	3	3	78
Plant Layout	-		-	3	3	3	6	6	6	3	3	-	-	33
Industrial Engineer	-		3	3	3	3	3	6	6	6	3	-	-	36
Material Handling Engineer	-		-	-	3	3	3	3	3	-	-	-	-	15
Timing Coordinator	-		-	3	3	3	3	3	3	3	3	3	3	30
Quality Control Specialist	-		-	3	3	3	6	6	6	3	3	3	3	39
Finance	-		3	3	3	3	3	3	6	6	6	3	3	42
Industrial Relations	-		-	-	-	-	-	-	3	3	6	6	6	24
Training Program Development	-		-	3	3	3	3	3	3	3	3	3	3	30
Product Engineering Liaison	3		3	3	3	3	3	3	3	3				27

Ford Motor Company





	1981 (Quarters)				1982 (Quarters)				1983 (Quarters)				Total Program	
	Contract													
	1st	Award	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd		4th
Plant Engineering Mgr.	3		3	3	3	3	3	3		3	3	3	3	36
Civil Engineering - Site Selection	3		3	3	3	3	3							21
Structural Design Engineer				3	3	3	3							15
Mechanical Engineer				3	3	3	3							15
Electrical Engineer				3	3	3		3						18
Construction Estimator					3	3	3							12
Maintenance Equipment Specialist					3	3								9
Draftsmen				3	3	3	3							15
Resident On-Site Construction Engineer				3	6	18	18	18	18	18	12	12	12	135
Supply Operations Mgr.					3	3	3	3	3	3	3	3	3	27
Production Control Specialist						3	3	3	3	3	3	3	3	24
Purchasing Analyst						3	6	6	6	6	3	3		33
Traffic Coordinator							3	3	3	3	3	3	3	21
Clerical/Typist														69
Total Man Months	18		30	75	105	132	147	153	147	117	96	81	72	1,173

Cost Figures \$(000)	Wage Costs	\$4,700
	Travel Costs	100
	Office Rental	175
	Communications & Office Supplier	75
	Miscellaneous	50
	Total Program Engineering Cost	<u>\$5,100</u>



## Section 10.0

## Heliostat Manufacturing Study

PRODUCTION ACCELERATION LAUNCH PLAN

A modified application of the basic learning curve concept has been applied in development of the proposed production acceleration launch plan. This method has been utilized in the automotive industry for new model launch programs in general and for new plant start ups in lower volume overseas assembly operations.

In place of the geometric unit progression used for very low volume plans, this use of the learning curve maintains a straight line time frame against a progressive learning rate improvement.

For the Heliostat Manufacturing Study, a learning rate of 85% has been used in consideration of a new plant, an entirely new product and an inexperienced work force.

Initial start-up follows proven operational capability from each machine and assembly operations completed through all phases. It has been considered that following the preactivation phase, a period of one week would be required to fully validate synchronization of systems, complete approximately 10 training build units and familiarize all operators with their work assignments at the 13 UPH (Units Per Hour) planned production rate.

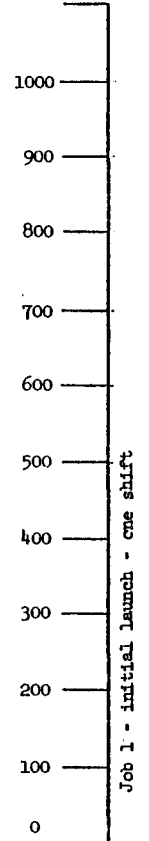
During the week preceeding "Job 1" with a direct labor force of 185 men on one shift,, it is anticipated that one set of heliostat components ready for shipment will be completed each day (185 men X 8 hours = 1480 hrs/unit; 5 units/week) and the plant system will be "full" at the level of normal running production.

The first week of launch begins the 85% learning curve rate:  $148 \text{ hours} \times .85 = 1258 \text{ hrs/unit}$ ;  $5 \text{ units/week} \div .85 = 6 \text{ units/week}$ . Subsequent production is shown on the following Launch Plan Curve.

Heliostat Manufacturing Study  
PRODUCTION ACCELERATION LAUNCH PLAN

**Plant Operating Pattern**  
245 work days per year  
49 work weeks per year  
16 hours per day - two shifts

Production Volume - Trucks Per Week



No. of Weeks Following Job 1	Weekly Production Volumes			Annual Total
	1st Shift	2nd Shift	Total	
1	6		6	
2	7		7	
3	8		8	
4	9		9	
5	11		11	
6	13		13	
7	16		16	
8	19		19	
9	22		22	
10	25		25	
11	30		30	
12	35		35	
13	41		41	
14	46		46	
15	51		51	
16	57		57	
17	61		61	
18	67		67	
19	71		71	
20	76		76	
21	81		81	
22	86		86	
23	91		91	
24	96		96	
25	101		101	
26	106		106	
27	111		111	
28	116		116	
29	121		121	
30 thru 45	520	520	1040	5200
46	520	40	560	5600
47	520	50	570	5700
48	520	63	583	5830
49	520	78	598	5980
50	520	97	617	6170
51	520	121	641	6410
52	520	151	671	6710
53	520	190	710	7100
54	520	240	760	7600
55	520	291	811	8110
56 thru 98	520	463	983	9830
99	520	520	1040	10400
100	520	520	1040	10400

TRAINING - PREACTIVATION & LAUNCHING COSTS  
MANUFACTURING PLANT

	\$(000)	\$(000)	\$(000)
	<u>First</u>	<u>Second</u>	<u>Total</u>
	<u>Shift</u>	<u>Shift</u>	
<u>Training</u>			
Direct Labor	\$ 350	\$ 350	\$ 700
Indirect Hourly	886	612	1,498
Salary	<u>883</u>	<u>308</u>	<u>1,191</u>
Total Training	\$ 2,119	\$1,270	\$ 3,389
<u>Preactivation</u>			
Direct Labor	\$ 255	\$ 183	\$ 438
Indirect Hourly	437	171	608
Salary	828	113	941
Variable Overhead (150%)	383	275	658
Launch Team Specialists <sup>a/</sup>	414	-	414
Tryout Parts	70	-	70
Vendor Assistance	<u>100</u>	<u>-</u>	<u>100</u>
Total Preactivation	\$ 2,487	\$ 742	\$ 3,229
<u>Launching</u>			
Direct Labor	\$ 1,416	\$ 469	\$ 1,885
Indirect Hourly	1,652	374	2,026
Salary <sup>b/</sup>	-	-	-
Variable Overhead	2,125	705	2,830
Launch Team Specialists <sup>a/</sup>	<u>216</u>	<u>-</u>	<u>216</u>
Total Launching	\$ 5,409	\$1,548	\$ 6,957
Combined Total			
Training, Preact. & Launch	\$10,015	\$3,560	<u>\$13,575</u>

a/ Includes salaries, travel and living expenses  
b/ Salary costs after Job 1 are included in total as operating budget per Ford Motor Co. policy

Reference: Appendix C



## Heliostat Manufacturing Study

TRAINING, PREACTIVATION & LAUNCHING COSTSFINAL FIELD ASSEMBLY PLANT

(SINGLE SITE)

	\$(000)	\$(000)	\$(000)
	<u>First</u>	<u>Second</u>	<u>Total</u>
	<u>Shift</u>	<u>Shift</u>	
<u>Training</u>			
Direct Labor	\$ 17	\$ 15	\$ 32
Indirect Hourly	20	16	36
Salary	<u>34</u>	<u>21</u>	<u>55</u>
Total Training	\$ 71	\$ 52	\$123
<u>Preactivation</u>			
Direct Labor	\$ 26	\$ 11	\$ 37
Indirect Hourly	12	5	17
Salary	8	5	13
Variable Overhead	26	11	37
Specialist Assistance	<u>5</u>	<u>-</u>	<u>5</u>
Total Preactivation	\$ 77	\$ 32	\$109
<u>Launching</u>			
Direct Labor	\$ 39	\$ 22	\$ 61
Indirect Hourly	19	10	29
Variable Overhead	39	24	63
Specialist Assistance	<u>5</u>	<u>-</u>	<u>5</u>
Total Launching	\$102	\$ 56	\$158
Combined Total			
Training, Preact. & Launch	\$250	\$140	<u>\$390</u>

Reference: Appendix C



## Heliostat Manufacturing Study

LAUNCH TEAM SPECIALISTS

<u>Function/Speciality</u>	<u>Number of Men</u>	<u>Total Man Months Required</u>
Tool and Fixture Design Engineer	2	9
Gear Cutting Specialist	2	10
Stamping Specialist	2	7
Machining Specialists	2	9
Assembly Specialist	1	3
Galvanizing Specialist	1	3
Paint Specialist	1	4
Heat Treat Specialist	1	4
Material Handling Engineer	1	3
Industrial Engineer	1	4
Quality Control Engineer	1	5
Plant Equipment Engineers	3	14
Production Control/Supply Specialists	2	8
Product Design Engineers	3	14
Industrial Relations Specialists	<u>2</u>	<u>7</u>
Totals	25	104

In addition to the above, special assistance will be provided by vendors for training and launching purposes related to operating and maintaining their equipment.





## Section 11.0

## Heliostat Manufacturing Study

SAVINGS OPPORTUNITIES

- 1) As discussed in Section 2, the supplied design information was reviewed for manufacturing feasibility on a production basis and several changes were proposed and agreed upon by FACC engineering to achieve more cost effective production level processes. The major changes and clarifications which were used as the basis for this study are listed below.
  - (a) One model (all units identical).
  - (b) Torque tube to be (1) piece welded steel tubing with expanded local areas to maintain outer diameter size tolerance where required for fitting adapter rings and flanges.
  - (c) Flanges - outboard and inboard to be rolled and welded steel rings.
  - (d) Adapter rings to be a (2) piece design consisting of a rolled end welded steel ring and a bolted-on finished machined steel casting "swivel extension".
  - (e) Above flanges and adapter rings (less swivel extensions) to be expanded to size and then puddle welded to the tube to form a torque tube assembly.
  - (f) An assembly will be added consisting of the above torque tube assembly, an actuating arm assembly and a left-hand and right-hand swivel extension, all fastened together with bolts and nuts. The journal pin bores in the actuating arm will be finished machined in this assembly in relationship to the previously finished swivel extension bores.
  - (g) All Winsmith Company designs provided for azimuth/drive bearing and elevation drive are for prototype build and can be modified to reflect normal Ford production design practices, i.e., castings instead of weldments and production machining tolerances. All gear tooth tolerances can be maintained by automotive hobbing, shaping and shaving techniques -- no gear tooth grinding is required.
  - (h) Tolerances for all parts will be per automotive industry production design practices for similar function parts.
- 2) The cost adjustments estimated immediately following the detailed processing, but included in the estimated costs are listed below:
  - (a) Reduced material in the planetary drive castings.
  - (b) Revised main seal for the planetary drive.
  - (c) Revised seal for the elevation actuator.



- (d) Providing ohly primer paint for the gimbal castings with final paint as an aesthetic customer option.
  - (e) Revised attachment supports and brackets for the wiring and sensors.
- 3) In addition to the manufacturing feasibility design changes incorporated into this manufacturing cost study, there are other opportunities for achieving lower production costs. These opportunities require more engineering and source development time than was available for this study to evaluate their feasibility. Listed below are opportunities which should be considered in any future phases.
- (a) Because of the high original expenditures and ongoing costs and environmental problems associated with galvanizing, other protective coatings should be considered as alternatives. One possible substitute is acrylic resin paint which is very durable.
  - (b) The use of existing commercial worm gear drive assemblies or components should be investigated by Product and Manufacturing Engineering.
  - (c) Investigate additional redesigning of various mounts, covers, etc. for motor revolution counter and zero reference mounting from weldments to PVC plastic formed components.
  - (d) Eliminate or reduce quantity of angle steel reinforcements in H-Frame Assembly by adding stamped ribs or flanged opening reinforcements to beams.
  - (e) Redesign the (48) attachment brackets for holding the reflectors to incorporate an adjustable feature and eliminate the select fit nylon spacers.
  - (f) Investigate use of electostatic paint technique for material savings (on gimbal and elevation drive final assemblies).
  - (g) Evaluate eliminating the safety wiring on the reflector assemblies (possibly through re-design of attachment bracket recommended in #e).



Section 12.0

Heliostat Manufacturing Study

SUGGESTED SELLING PRICE

Based on a typical business plan, this section develops the methodology for determining a suggested selling price.

The manufacturing operations are based on a volume of 50,000 units per year on a two shift operating plan for at least ten years following the initial launch year. Two field sites will be in operation simultaneously to assemble the complete heliostats. Start up of the field operations will be staggered for the two sites and a building at the third site will be prepared to minimize delay.

Variable costs and investment costs are obtained from Sections 6 and 7 respectively.



COST ASSUMPTIONS

- 1) Variable burden costs include indirect labor, variable fringe, operating supplies, fuels, utilities, expense tools, and maintenance materials.
- 2) Warranty is 4% of raw materials.
- 3) All depreciable assets use declining balance depreciation rates. The buildings and land improvements have a 30 year depreciable life and the machinery and equipment have a 12 year life.
- 4) Design changes or obsolescence are 1.5% of raw materials.
- 5) Non-variable overhead includes the wages (mid-point Grade 6), fringe, and cost-of-living allowance for the salary manpower requirements.
- 6) The administrative cost assumes three salary heads at the mid-point of a Grade 9.
- 7) The general overhead rate is 2.5% of total variable costs.
- 8) The cycle length for the study assumes 10 years.
- 9) Economics are at 1980 conditions.



## HELIOSTAT MANUFACTURING STUDY

CALENDAR YEARS AT 1980 ECONOMICS

	1st YEAR (\$000)	2nd YEAR (\$000)	3rd YEAR (\$000)	4th YEAR (\$000)	5th YEAR (\$000)	6th YEAR (\$000)	7th YEAR (\$000)	8th YEAR (\$000)	9th YEAR (\$000)	10th YEAR (\$000)	TOTAL (\$000)	PER UNIT		
<b>REVENUE (ASSUMING 10% RETURN ON SALES)</b>	\$40,980	\$136,600	\$136,600	\$136,600	\$136,600	\$136,600	\$136,600	\$136,600	\$136,600	\$136,600	\$1,406,980	\$ 2,772	100.0	
<b>VARIABLE COSTS</b>														
RAW MATERIAL	\$10,635	\$ 35,450	\$ 35,450	\$ 35,450	\$ 35,450	\$ 35,450	\$ 35,450	\$ 35,450	35,450	35,450	\$ 35,450	\$ 365,115	\$ 709	25.9
PURCHASED FINISHED PARTS	11,295	37,650	37,650	37,650	37,650	37,650	37,650	37,650	37,650	37,650	387,295	753	27.6	
DIRECT LABOR - MANUFACTURING	1,380	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	4,600	47,180	92	3.6	
- FIELD ASSEMBLY	555	1,850	1,850	1,850	1,850	1,850	1,850	1,850	1,850	1,850	19,055	37	1.4	
VARIABLE BURDEN - MANUFACTURING	4,860	16,200	16,200	16,200	16,200	16,200	16,200	16,200	16,200	16,200	166,860	324	13.9	
- FIELD ASSEMBLY	1,125	3,750	3,750	3,750	3,750	3,750	3,750	3,750	3,750	3,750	38,625	75	2.7	
WARRANTY	420	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400	14,620	28	1.0	
<b>TOTAL VARIABLE COSTS</b>	\$30,270	\$100,900	100,900	100,900	100,900	100,900	100,900	100,900	100,900	100,900	\$1,019,270	\$ 2,018		
<b>ECONOMIC PROFIT</b>	\$10,710	\$ 35,700	35,700	35,700	35,700	35,700	35,700	35,700	35,700	35,700	\$ 367,710	\$ 716		
<b>FIXED COSTS</b>														
<b>MANUFACTURING PLANT</b>														
• PROGRAM ENGINEERING	5,100										\$ 5,100	10	0.4	
• TRAINING, PREACTIVATION, LAUNCH	13,575										\$ 13,575	26	0.9	
• DEPRECIATION - BUILDING	1,516	1,411	1,314	1,223	1,140	1,062	980	923	861	803	\$ 11,991	23	0.8	
- EQUIPMENT	9,364	7,826	6,551	5,499	4,626	3,906	3,306	2,811	2,402	2,062	\$ 49,703	97	3.5	
<b>FIELD ASSEMBLY</b>														
• PROGRAM ENGINEERING	780										780	2	0.1	
• TRAINING, PREACTIVATION, LAUNCH	23	21	20	18	17	16	15	14	13	11	180			
• DEPRECIATION - BUILDING	440	368	308	259	218	184	156	132	113	97	63	2,338	5	0.2
- EQUIPMENT	1,200	2,800	2,800	2,800	1,200	2,800	2,800	2,800	2,800	2,800	30,000	58	2.1	
<b>NON-VARIABLE OVERHEAD</b>	5,220	7,331	7,331	7,331	7,331	7,331	7,331	7,331	7,331	7,331	78,530	152	5.6	
DESIGN CHANGES (OBsolescence)	160	532	532	532	532	532	532	532	532	532	5,680	11	0.4	
ADMINISTRATIVE - DIRECTLY RELATED	289	145	145	145	145	145	145	145	145	145	1,379	3	0.1	
GENERAL OVERHEAD	2,522	2,522	2,522	2,522	2,522	2,522	2,522	2,522	2,522	2,522	27,762	54	2.0	
<b>TOTAL FIXED COST</b>	\$40,189	\$22,956	\$21,525	\$20,329	\$19,731	\$18,696	\$17,797	\$17,210	\$ 17,119	\$ 16,304	\$ 15,504	\$ 227,160	\$ 441	
<b>PROFIT BEFORE TAXES</b>	\$(29,479)	\$12,744	\$14,175	\$15,371	\$15,969	\$17,204	\$17,903	\$18,490	\$ 18,581	\$ 19,396	\$ 20,196	\$ 140,550	\$ 273	10.0
<b>VOLUME</b>	15,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	515,000	1		

\* INCLUDED IN MANUFACTURING PLANT

Heliostat Manufacturing Study  
MANUFACTURING PROCESS ESTIMATE SHEETS

Manufacturing process estimate sheets, as described in "Study Objectives" (Section 1.0), for each make part or assembly, are included with this study transmittal. These sheets also include all other pertinent data related to that part, including flow diagrams, area layouts, sketches, vendor information, etc. The sheets have been segregated into major components as listed below. These major categories are then further subdivided by individual part number or assembly as shown in a breakdown at the beginning of each major section. The major component categories agree with Section 6 in the main body of the Study.

<u>Major Component Description</u>	<u>Page No.</u>
● Gimbal and Azimuth Drive/Bearing Assembly	A-2
● Elevation Drive Assembly	A-143
● Reflector Panel Support (H-Frame/Brackets)	A-230
● Torque Tube Assembly/Arm Assembly	A-248
● Gimbal/Actuator Detail Items (Trunnion/Pins)	A-273
● Attachments for Wiring and Sensors	A-281
● On-Site Heliostat Assembly	A-313

Individual piece item numbers correspond with the complete parts list of Section 6.3. A manufacturing process estimate sheet is presented for each assembly and each "make" item.

PROCESS ESTIMATE SHEETS  
GIMBAL AND AZIMUTH DRIVE/BEARING ASSEMBLY

Shop Assembly

A-5

Set 1A: (#D-651133-18)

Sheet 1-2	Assembly Frame and Planet Gears
Sheet 3	Sub-Assembly Frame and Planet Gears
Sheet 4	Frame and Planet Gears; Sub-assembly
Sheet 5	Frame and Planet Gear Assembly
Sequence sketch	

Set 1B: (#D-651133-18/531436)

A-11

Sheet 1	Lubricate Ball Bearings
Sheet 2	Sub-assemble Bearings, Spacers Gear to Shaft
Sheet 3	Sub-assemble Shaft Seal to Worm Gear Housing
Sheet 4	Sub-assemble Bushing to Worm Gear Housing
Sheet 5	Sub-assemble Seals to Shaft Cover
Sheet 6	Assemble Shaft to Worm Gear Housing
Sheet 7	Sub-assemble Bearing and Seal to Worm
Sheet 8	Sub-assemble Bearing to Worm Shaft Cap
Sheet 9	Assemble Worm to Worm Gear Housing
Sheet 10	Assemble Bearing to Worm Gear Housing
Sheet 11	Sub-assemble Seal to Motor Adapter
Sheet 12	Assemble Motor Adapter to Worm Gear Housing
Sheet 13	Sub-Assemble Coupling to Motor Shaft
Sheet 14	Assemble Motor to Motor Adapter
Sheet 15	Assemble Pipe Plugs and Alemite Fittings
Sheet 16	Sub-assemble Magnet Holder to Rev. Counter Adapter
Sheet 17	Sub-assemble Rev. Counter Adapter to Sleeve
Sheet 18	Assemble Magnet Holder to Worm Shaft
Sheet 19	Assemble Rev. Counter Adapter/Sleeve to Worm Housing
Sheet 20	Adjust Gap between Magnet and IC's
Sheet 21	Assemble Cover to Motor Rev. Counter
Sheet 22	Assemble Pinion to End of Reducer Shaft
Sheet 23	D.L. Standards Recap
Sheet 24	Facility and Tooling Cost Summary
Sequence Sketch	

Set 1C: (#D-651133-18/531436)

A-36

Sheet 1-2	Planetary Drive Assembly
Sheet 3	Assemble Bearing Balls and Secondary Ring Gear
Sheet 4-5	Planetary Drive Assembly/Gimbal Housing
Sheet 6	Facility and Tool Cost Summary
Sheet 7	Direct Labor Standards Recap
Sequence Sketch	

Item 1 Worm Gear Housing #790234

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Sheet 1-3	Housing - Worm Gear
Sheet 4	Plant Engineering Requirements
Sequence Sketch	

<u>Item 2 High Speed Cap</u>	#800240	A-49
Sheets 1-4	High Speed Cap-Open	
Sheet 5	Plant Engineering Requirements	
Sequence Sketch		
<u>Item 3 Slow Speed Shaft Cover</u>	#800241	A-55
Sheets 1-3	Slow Shaft Cover	
Sheet 4	Plant Engineering Requirements	
Sequence Sketch		
<u>Item 5 Slow Speed Shaft</u>	#830234	A-60
Sheets 1-9	Slow Speed Shaft	
Sheet 10	Plant Engineering Requirements	
Sequence Sketch		
<u>Item 7 S.S. Shaft Spacer - Short</u>	#835235	A-71
Sheets 1-3	S.S. Spacer Short	
<u>Item 8 S.S. Shaft Spacer - Long</u>	#835236	A-74
Sheets 1-3	S.S. Spacer Long	
<u>Item 9 H.S. Housing Bushing</u>	#835234	A-77
Sheets 1-3	H.S. Housing Bushing	
Sheet 4	Plant Engineering Requirements	
Sequence Sketch		
<u>Item 23 Base</u>	#926610	A-82
Sheets 1-5	Base Housing	
Sheet 6	Plant Engineering Requirements	
Sequence Sketch		
<u>Item 24 Cover</u>	#926220	A-89
Sheets 1-5	Cover-Housing	
Sheet 6	Plant Engineering Requirements	
Sequence Sketch		
<u>Item 25 Planet Gear</u>	#936140	A-96
Sheets 1-3	Planet Gear	
Sheet 4	Plant Engineering Requirements	
Sequence Sketch		
<u>Item 26 Planetary Frame</u>	#926310	A-101
Sheets 1-5	Planetary Frame	
Sheet 6	Plant Engineering Requirements	
Sequence Sketch		



<u>Item 27 Primary Ring Gear</u>	#936710	A-108
Sheets 1-8	Primary Ring Gear	
Sheet 9	Plant Engineering Requirements	
Sequence Sketch		
<u>Item 28 Secondary Output Ring Gear</u>	#936440	A-118
Sheets 1-6	Output Ring Gear (Secondary)	
Sheet 7	Plant Engineering Requirements	
Sequence Sketch		
<u>Item 29 Friction Ring</u>	#926360	A-126
Sheet 1	Friction Ring	
Sheet 2	Plant Engineering Requirements	
<u>Item 31 Journal Pin</u>	#926361	A-128
Sheets 1-4	Journal Pin	
Sheet 5	Plant Engineering Requirements	
<u>Item 37 Ball Retaining Bolt</u>	#926913	A-133
Sheet 1	Ball Retaining Bolt	
Sheet 2	Plant Engineering Requirements	
<u>Gimbal Housing</u>	#531146	A-135
Sheets 1-5	Gimbal Housing	
Sheet 6	Plant Engineering Requirements	
Sequence Sketch		
Position Sketch		

1A

PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR SER. NO. HELIOSTAT		PART NAME ASSEMBLY FRAME & PLANET GEARS				ISSUE DATES 4-8-80		PART NO. D-651133-18-B							
FOR MODELS 50,000/YEAR NBT		MATERIAL		WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 1 OF 2						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR D.T. NUMBER	MACH. REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				DEPEND. COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
	THIS SUB-ASSEMBLY CONSISTS OF:														
	1 - FRAME #26														
	6 - NEEDLE BRG. #38														
	6 - RINGS #29														
	3 - PINS #31														
	3 - PLANET GEARS #25														
	PRESS #38 BRG. INTO FRAME #26 (6) PLACES	ASS'Y FIXTURE & PRESS	1			6,000	2,000	1,000	3,000	30,000					
10	P.U. & POS. FRAME TO (#26) BENCH FIXTURE				.20										
20	APPLY OIL TO (3) BRG. BORES OF THE FRAME	APPLICATOR	1		.15	1,000			1,000	3,000					
30	P.U. BRG. AND POS. 1" TO RAM OF MANUAL LEVER PRESS	BEARING PRESS			.15	3,000	2,500		500	2,000					
TOTALS						10,000				35,000					
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR. S. LEWIS	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR. OHANESTAN	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME		REQ'D. PER VEHICLE PC/HR. HRS.	NEXT ASSY: SUPERSEDES.	OPER. NO. 10				

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(1A)

PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR ECR NO. HELIOSTAT		PART NAME ASSEMBLE FRAME & PLANET GEARS				ISSUE DATES 4-9-80		PART NO. D-651133-18-B							
FOR MODELS 50,000 YEAR NET		MATERIAL		WT./ LBS.	RGH.	FIN.	RELEASE	SHEET 2 OF 2							
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
40	PRESS BRG. TO DEPTH				.10										
50	ROTATE FIXTURE TO NEXT BORE				.05										
60	REPEAT OPERS. 30, 40 & 50 TWO ADDITIONAL TIMES				.60										
70	TURN FRAME TO OPPOSITE SIDE				.15										
80	REPEAT OPERATIONS 20 30, 40, 50 & 60				1.05										
TOTALS					2.45										
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO.				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:		10				

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1A

PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

PROGRAM OR CEE NO. HELIOSTAT		PART NAME SUB-ASSEMBLY FRAME & PLANET GEARS				ISSUE DATES 9-16-80		DEPARTMENT PART NO. D-651133-18-B							
FOR MODELS		MATERIAL		WT./LBS.	RGH.	FIN.	RELEASE	SHEET 1 OF 1							
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYS/25		
10	POSITION PLANET GEAR (25) AND FRICTION RING (29) - UPPER AND LOWER TO PLANETARY FRAME (26)				1.10										
20	ALIGN HOLES AND INSERT JOURNAL PIN (31) TO FRAME & GEAR AND PRESS INTO POSITION	ALIGNMENT TOOL			.50	(USE PRESS FROM OPER #10)									
30	REPEAT ELEMENTS 10 & 20 TWO MORE TIMES FOR 2nd & 3rd PLANET GEARS				1.80										
40	TRANSFER TO LINE STORAGE RETURN FIXTURE TO START OF SUB-ASSEMBLY AREA	HOIST WITH SPECIAL ADAPTOR HOOK			.25	5,000				1,000					
	PERSONAL RELIEF				20										
TOTALS					3.15	5,000				1,000					
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASBY:	OPER. NO.					
		INDUSTY. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:	20					

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PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

DEPARTMENT \_\_\_\_\_

PROGRAM OR P/R NO. HELIOSTAT		PART NAME FRAME & PLANET GEARS - SUB-ASSEMBLY				ISSUE DATES				PART NO. D-651133-18-B				
FOR MODELS 50,000 YEAR NET		MATERIAL DIR. LAB SPDS. RECAP				WT./ LBS.				RELEASE		SHEET 1 OF 1		
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'Y REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL- LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
10					2.45									
20					3.15									
					5.60									
	PERSONAL RELIEF				.40									
TOTALS					6.00									
REMARKS														
		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:					

*Stev* Mfg. Development  
Engrg. & Research

PROCESS ESTIMATE SHEET

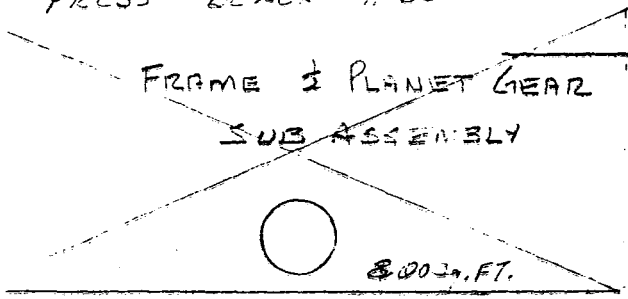
PLANT FORD AEROSPACE

DEPARTMENT:

PROGRAM OR ECR NO. HELICOPTAR		PART NAME FRAME & PLANET GEAR ASSEMBLY				ISSUE DATES 9-22-80		PART NO. JF-651133-18-B							
FOR MODELS		MATERIAL PLANT ENGINEERING		WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 5 OF 5						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST		
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD		INST. FRYG/23	
	ASSEMBLY TOOLING	TABLES, HAND	LOT			10,000	5,000		5,000	5,000					
	AID AIDS	& POWER TOOLS													
		RACKS, STANDS,													
		LIGHTING													
		TOOL RAIL & HOIST				6,000	3,000		3,000	2,000					
TOTALS						16,000				7,000					
REMARKS FLOOR SPACE = 800 SQ. FT.															
PROCESS ENGR.		PLT. LAYOUT		AUTOMATION		DESIGN		MATH. MDLG. ENGR.		DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:	
INDUSTR. ENGR.		LAB.		QUAL. CONTR.		PLT. ENGR. OHANESIAN		PRODN.		DAILY PLT. PLANNING VOLUME		REQMTS. PC/HR. HRS.		SUPERSEDES:	
Mfg. Development Engrg. & Research															

PRESS - BENCH - AIDS

FRAME & PLANET GEAR  
SUB ASSEMBLY



LOAD

OPER  
10

OPER  
20

OPER  
30

OPEN

OPER  
50

FUNCTIONAL  
TEST  
(O.D.)

TRANSITION  
UNLOAD

1A

40'

AZIMUTH GEAR REQUIRE  
20000 Sq. FT.

25000 Sq. FT.

25  
35

5700  
10000  
10000

PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

DEPARTMENT

PROGRAM OR ECR NO. HMLTOSPAT	PART NAME LUBRICATE BALL BEARINGS	ISSUE DATES 9-16-80	PART NO. D-651133-18-G
FOR MODELS AZIMUTH GEAR REDUCER ASSEMBLY	MATERIAL	WT./ LBS.	RGH. FIN.
		RELEASE	SHEET 1 OF 1

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRAVEL	
	PARTS REQUIRED:													
	(1) DET. #12 BALL BEARING													
	(2) " #13 " "													
	(1) " #14 " "													
	(1) " #15 " "													
10	OBTAIN BEARING FROM STOCK & POSITION TO BEARING PACKER. ACTUATE LEVER TO DISPENSE GREASE	BEARING PACKER	2		25									
20	REPEAT ELEMENT #10 FOR (4) MORE BEARINGS				80									
30	TRANSFER BEARINGS TO ASSEMBLY OPERATION				10									
TOTALS					1.15									
REMARKS														

Mfg. Development Engrg. & Research	PROCESS ENGR. L. PALMER	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR. OHANSTAN	MATL. MDLG. ENGR. PRDGN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME	REQ'D. PER VEHICLE REQNTS. PC/HR. HRS.	NEXT ASSY: SUPERSEDES:	OPER. NO. 10
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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR CCR NO. HRL10STAT		PART NAME SUB-ASSEMBLE BEARINGS, SPACERS, GEAR TO SHAFT				ISSUE DATES 9-16-80		PART NO. D-651133-18-G						
FOR MODELS AZ12PHH GEAR REDUCERS ASSEMBLY		MATERIAL				WT./LBS.	RGH.	FIN.	RELEASE	SHEET 1 OF 1				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
	PARTS REQUIRED:													
	(1) DETAIL #5 SHAFT													
	(1) " #14 BALL BEARING	(FROM PREV. OPER.)												
	(1) " #15 " " "	( " " " )												
	(1) " #7 SHAFT SPACER													
	(1) " #8 " " "													
	(1) " #6 WORM GEAR													
	(1) " #50 GEAR KEY													
10	OBTAIN DET. #5 SHAFT, POSITION TO PRESS	ARBOR PRESS			25									
20	OBTAIN DET. #15 BEARING, POSITION TO SHAFT AND PRESS IN POSITION				25									
30	OBTAIN DET. #8 SPACER, POSITION TO SHAFT				15									
40	OBTAIN DET. #6 GEAR & DET. #50 KEY, POSITION KEY IN SLOT ON SHAFT, ASSEMBLE GEAR TO SHAFT, OBTAIN DET. #7 SPACER & POSITION TO SHAFT	MANIAT.			30									
50	OBTAIN DET. #14 BEARING, POSITION TO SHAFT & PRESS IN POSITION				25									
60	TRANSFER ASSY TO NEXT OPERATION				.10									
TOTALS					1.30									
REMARKS														
Mfg. Development Engr. & Research		PROCESS ENGR. I. PALMER	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO. 20				
		INDUSYR. ENGR. S. TREVIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQNTS. PC/HR. HRS.	SUPERSEDES:					

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PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

DEPARTMENT:

PROGRAM OR CEN NO. HELIOPTAT		PART NAME SUB-ASSEMBLE SHAFT SEAL TO WORM GEAR HOUSING				ISSUE DATES 9-16-80		PART NO. D-651133=18-G						
FOR MODELS AZIMUTH GEAR REDUCER ASSEMBLY		MATERIAL		WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 1 OF 1					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD		INST. (BYO?)
	PARTS REQUIRED: (1) DETAIL #1 WORM GEAR HOUSING (2) DETAIL #21 SEAL													
10	OBTAIN DETAIL #1 HOUSING & POSITION ON PRESS	ARBOR PRESS			.20									
20	OBTAIN (2) EACH OF DETAIL #21, POSITION TO ADAPTER AND PRESS INTO HOUSING				30									
30	TRANSFER ASSEMBLY TO NEXT OPERATION				10									
TOTALS						0.60								
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR. I. PALMER	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. HDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME	REQ'D. PER VEHICLE PC/HR.	NEXT ASSY: SUPERSEDES:	OPER. NO. 30				

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR PCH NO. HELICOPTAR	PART NAME SUB-ASSEMBLE BUSHING TO WORM GEAR HOUSING	ISSUE DATES 9-16-80	DEPARTMENT PART NO. D-651133-18-G
FOR MODELS AZIMUTH GEAR REDUCER ASSEMBLY	MATERIAL	WT./ LBS.	RELEASE
		RGH.	SHEET 1 OF 1
		FIN.	

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
	PARTS REQUIRED:														
	(1) DET. #1 HOUSING (FROM PREV. OPER.)														
	(1) DET. #9 HOUSING BUSHING														
10	POSITION HOUSING TO PRESS	ARBOR PRESS			.20										
20	OBTAIN DET. #9 BUSHING, POSITION TO HOUSING AND PRESS IN PLACE				.25										
30	TRANSFER ASSEMBLY TO NEXT OPERATION				.10										
TOTALS					SUB TOTAL - OPER. 40	0.55									

REMARKS

	PROCESS ENGR. I. PALMER	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. HDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME	REQ'D. PER VEHICLE PC/HRS.	NEXT ASSY: SUPERSEDES:	OPER. NO. 40
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Mfg. Development  
Engr. & Research

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR P/N NO. HKL10STAT		PART NAME SUB-ASSEMBLY SEALS TO SHAFT COVER				ISSUE DATES 9-16-80		PART NO. D-651133-18-G							
FOR MODELS AZIMUTH GEAR REDUCER ASSEMBLY		MATERIAL		WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 1 of 1						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR D.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TOOLS		
	PARTS REQUIRED: (1) DETAIL #3 COVER (2) DETAIL #21 SEAL														
10	OBTAIN DET. #3 COVER, POSITION TO PRESS	ARBOR PRESS			.20										
20	OBTAIN (2) DET. #21 SEALS, POSITION TO COVER & PRESS INTO POSITION				.30										
30	TRANSFER COVER ASSEMBLY TO NEXT OPERATION				.10										
TOTALS						0.60									
REMARKS															
Mfg. Development		PROCESS ENGR. L. PALMER	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:		OPER. NO.		
Engrg. & Research		INDUSTRIAL ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME		REQMTS. PC/HR. HRS.		SUPERSEDES:		50		

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT: (19)

PROGRAM OR ECR NO. HELIOSTAT		PART NAME ASSEMBLE SHAFT TO WORM GEAR HOUSING			ISSUE DATES 9-16-80		PART NO. D-651133-18-G							
FOR MODELS AZTUMPH GEAR REDUCER ASSEMBLY		MATERIAL		WT./LBS.	RGH.	FIN.	RELEASE		SHEET 1 OF 1					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRVCT	
	PARTS REQUIRED:													
	(1) DET. #1 WORM GEAR HOUSING (FROM PREV. OPER.)													
	(1) " #5 SHAFT (FROM PREV. OPER.)													
	(1) " #11 COVER GASKET													
	(4) " #44 1/4-20 BOLTS													
	(4) " #53 LOCKWASHER													
	(4) " #62 SPACER													
	(1) " #3 COVER (FROM PREV. OPER.)													
10	OBTAIN WORM GEAR HOUSING ASSEMBLY, POSITION IN FIXTURE	GEAR REDUCER ASSEMBLY FIXTURE			.20									
20	OBTAIN SHAFT ASSEMBLY, ASSEMBLE TO HOUSING	MANUAL			.20									
30	OBTAIN DET. #11 GASKET, POSITION GASKET TO HOUSING				.15									
40	OBTAIN COVER ASSEMBLY, POSITION OVER SHAFT AND TO HOUSING, LOOSE ASSEMBLE (4) DET. #62 SPACERS, (4) DET. #53 T/WASHER & (4) DET. #44 BOLTS				.70									
50	SECURE (4) BOLTS WITH POWER TOOL	PNEUMATIC PISTOL GRIP NUTRUNNER			.20									
TOTALS						1.45								
REMARKS														
Mfg. Development Engr. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO. 60			
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQ'TS. PC/MR.	MRS.	SUPERSEDES.				

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PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

PROGRAM OR PART NO. D-651133-18-G		PART NAME SUB-ASSEMBLE BEARING & SEAL TO WORM				ISSUE DATES 9/16/80				DEPARTMENT				
FOR MODELS ALUMPHI GEAR REDUCER ASSEMBLY		MATERIAL				WT./ LBS. RGH. FIN.				RELEASE		SHEET 1 OF 1		
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
	PARTS REQUIRED: (1) DETAIL #4 WORM (1) " #13 BEARING (FROM PREV. OPER.) (1) " #20 SEAL													
10	OBTAIN DET. #4 WORM, POSITION TO PRESS	ARBOR PRESS			.25									
20	OBTAIN DET. #13 BEARING, POSITION TO WORM SHAFT & PRESS INTO PLACE				.25									
30	OBTAIN DET. #20 SEAL & POSITION ON WORM SHAFT				.15									
40	TRANSFER WORM ASSEMBLY TO NEXT OPERATION				.10									
TOTALS						0.75								
REMARKS														
Mfg. Development Engg. & Research		PROCESS ENGR. I. PALMER	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO. 70				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:					

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PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

DEPARTMENT:

PROGRAM OR CTR NO. 101103PAT		PART NAME SUB-ASSEMBLE BEARING TO WORM SHAFT CAP				ISSUE DATES 9/16/80		PART NO. D-651133-18-G							
FOR MODELS A11MPTH GEAR REDUCER ASSEMBLY		MATERIAL			WT./LBS.	RGH.	FIN.	RELEASE	SHEET	OF					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRVCT		
	PARCS REQUIRED: (1) DETAIL #2 CAP (1) " #17 RETAINING RING (1) " #13 BEARING (FROM PREV. OPER.)														
10	OBTAIN DET. #2 CAP POSITION ON PRESS	ARIOR PRESS			.25										
20	OBTAIN DET. #13 BEARING POSITION TO CAP & PRESS IN PLACE				.25										
30	OBTAIN DET. #17 RETAINING RING ASSEMBLE TO GROOVE IN CAP	HAND TOOL			.20										
40	TRANSFER CAP ASSEMBLY TO NEXT OPERATION				.10										
TOTALS						0.80									
REMARKS															
Mfg. Development Engr. & Research		PROCESS ENGR. J.P.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
		INDUSTY. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR.	SUPERSEDES: HRS.	80					

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR CTR NO. HELIOSTAT		PART NAME ASSEMBLE WORM TO WORM GEAR HOUSING				ISSUE DATES 9-16-80		PART NO. D-651133-18-G						
FOR MODELS AZ110PHH GEAR REDUCER ASSEMBLY		MATERIAL				WT./ LBS.		RGH. FIN.		RELEASE SHEET OF				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTAL- LATION	TOTAL	DESIGN	BUILD	INST. LAYOUT	
	PARTS REQUIRED:													
	(1) DET. #1 WORM (FROM PREV. OPER.)													
	(1) DET. #2 CAP ( " " " )													
	(1) DET. #18 SUPPORT WASHER													
	(1) DET. #16 RETAINING RING													
	(1) DET. #19 SEAL													
	(1) DET. #10 GASKET													
	(4) DET. #43 1/4-20 BOLT													
	(4) DET. #53 LOCK WASHER													
10	OBTAIN WORM ASSEMBLY, ASSEMBLE TO HOUSING	GEAR REDUCER ASSY. FIXTURE			.20									
20	OBTAIN DET. #10 GASKET & DET. #2 CAP, POSITION OVER WORM SHAFT TO HOUSING, SECURE WITH (4) DETAIL #43 BOLTS & (4) DETAIL #53 LOCK WASHERS	PNEUMATIC PISTOL GRIP NUTRUNNER			.75									
30	OBTAIN DET. #18 WASHER & POSITION OVER WORM SHAFT, OBTAIN DET. #16 RETAINING RING & ASSEMBLE TO SHAFT	HAND TOOL			.40									
10	OBTAIN (2) DET. #19 SEAL AND ASSEMBLE OVER SHAFT INTO CAP				.30									
TOTALS		SUB TOTAL OPER. 90			1.65									
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR. I. PATMER	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSY. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQNTS. PC/HR. HRS.	SUPERSEDES:	90				

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR CER NO.		PART NAME			ISSUE DATES			PART NO.						
FOR MODELS AC/1000 GEAR REDUCER ASSEMBLY		ASSEMBLE BEARING TO WORM GEAR HOUSING COVER			9-16-80			D-651133-18-G						
MATERIAL		WT. / LBS.		RGH. FIN.		RELEASE		SHEET		OF				
								1		1				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYS	
	PARTS REQUIRED: (1) DET. #12 BEARING (FROM PREV. OPER.)													
10	OBTAIN DET. #12 BEARING, ASSEMBLE INTO END OF SHAFT	HAND TOOL	1		.25									
TOTALS					SUB TOTAL OPER. 100									
REMARKS														
PROCESS ENGR. T. PALMER		PLT. LAYOUT		AUTOMATION		DESIGN		MATH. MDLG. ENGR.		DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:
INDUSYN. ENGR.		LAB.		QUAL. CONTR.		PLT. ENGR.		PRODM.		DAILY PLT. PLANNING VOLUME		REQMTS. PC/HR. HRS.		SUPERSEDES:
Mfg. Development Engrg. & Research														
														100

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PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

DEPARTMENT:

PROGRAM OR EPA NO. HELICOPTER		PART NAME SUB-ASSEMBLY SEAL TO MOTOR ADAPTER				ISSUE DATES 9-16-80		PART NO. D-651133-18-G						
FOR MODELS A71B0TH GEAR REDUCER ASSEMBLY		MATERIAL		WT./ LBS.	RGH.	FIN.	RELEASE	SHEET 1 OF 1						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTAL- LATION	TOTAL	DESIGN	BUILD	INST. FRYOUT	
	PARTS REQUIRED: (1) DETAIL //19 SEAL (1) DETAIL //57 MOTOR ADAPTER													
10	OBTAIN DET. //57 MOTOR ADAPTER & POSITION TO PRESS	ARBOR PRESS			.20									
20	OBTAIN DET. //19 SEAL & POSITION TO MOTOR ADAPTER, PRESS IN PLACE				.25									
30	TRANSFER MOTOR ADAPTER TO NEXT OPERATION				.10									
TOTALS		SUB TOTAL OPER. 110			.55									
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO. 110			
		INDUSTY. ENGR.	L.AB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HRS.	HRS.		SUPERSEDES:			

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PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

DEPARTMENT:

PROGRAM OR CCR NO.		PART NAME				ISSUE DATES		PART NO.							
		ASSEMBLE MOTOR ADAPTER TO WORM GEAR HOUSING				9-17-80		D-651133-18-G							
FOR MODELS		MATERIAL				WT./	RGH.	FIN.	RELEASE		SHEET 1 OF 1				
AZIMUTH GEAR REDUCER ASSEMBLY						LBS.									
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S RECD.	NET HOURLY CAP.	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRAVEL		
	PARTS REQUIRED:														
	(1) DET. #57 MOTOR ADAPTER (FROM PREV. OPER.)														
	(4) DET. #58 1/4-20 BOLT														
	(4) DET. #53 LOCKWASHER														
10	OBTAIN DET. #57 MOTOR ADAPTER. POSITION TO WORM GEAR HOUSING. LOOSE ASSEMBLE (4) DET. #58 BOLTS & (4) DET. #53 LOCKWASHERS	GEAR REDUCER ASSEMBLY FIXTURE			50										
20	SECURE (4) BOLTS WITH POWER TOOL.	PNEUMATIC PISTOL GRIP RUNNER			.20										
TOTALS		SUB TOTAL OPER. 120			0.70										
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:		OPER. NO.		
		INDUSTRY ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODM.	DAILY PLT. PLANNING VOLUME		REQMTS. PC/HR. HRS.		SUPERSEDES:		120		

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PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

DEPARTMENT:

PROGRAM OR ECR NO. HELFOSTAT		PART NAME SUB-ASSEMBLY COUPLING TO MOTOR SHAFT				ISSUE DATES 9-17-80		PART NO. 531436, D-651133-18-G							
FOR MODELS AZIMUTH GEAR REDUCER ASSEMBLY		MATERIAL		WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 1 OF 1						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACH'G REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
	PARTS REQUIRED: (1) DETAIL #30 MOTOR (DWG-531436) (1) DETAIL #56 COUPLING (D-651133-18-G) (1) DETAIL #59 COUPLING KEY (D-651133-18-G)														
10	OBTAIN DET. #30 MOTOR, POSITION TO BENCH	BENCH			.20										
20	OBTAIN DET. #56 COUPLING & DET. # 59 KEY, POSITION KEY TO SLOT ON MOTOR SHAFT, ASSEMBLE COUPLING TO SHAFT	MANUAL			.40										
30	SECURE SET SCREW IN COUPLING	HAND TOOL			.15										
40	TRANSFER MOTOR TO NEXT OPERATION				.10										
TOTALS		SUB TOTAL OPER. 130			0.85										
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR. L. PALMER	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO. 130					
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODM.	DAILY PLT. PLANNING VOLUME	REQNTS. PC/HR. MAS.	SUPERSEDES:						

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PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

DEPARTMENT:

PROGRAM OR ECM NO. HHT10STAT	PART NAME ASSEMBLE MOTOR TO MOTOR ADAPTER	ISSUE DATES 9-17-80	PART NO. 531436
FOR MODELS AZIMUTH GEAR REDUCER ASSEMBLY	MATERIAL	WT./LBS.	RGH. FIN.
		RELEASE	SHEET 1 OF 1

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTAL-LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
	PARTS REQUIRED:													
	(1) DETAIL #30 MOTOR (FROM PREV. OPER.)													
	(4) DETAIL #33 1/4-20 BOLTS													
	(4) " #34 FLAT WASHER													
	(4) " #35 LOCKWASHER													
10	OBTAIN MOTOR & POSITION TO MOTOR ADAPTER, TOOSE ASSEMBLE (4) DET. #33 BOLTS, (4) DETAIL #34 F/WASHERS, (4) DET. #35 LOCKWASHERS	GEAR REDUCER ASSEMBLY FIXTURE			50									
20	SECURE (4) BOLTS WITH POWER TOOL	PNEUMATIC PISTOL GRIP NUTRUNNER			20									
30	SECURE SET SCREW IN COUPLING TO WORM SHAFT THRU HOLE IN MOTOR ADAPTER	HAND TOOL			15									
TOTALS						0.85								

REMARKS

Mfg. Development Engrg. & Research	PROCESS ENGR. L. PATMEK	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASBY:	OPER. NO. 140
	INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQYTS. PC/HRS. HRS.	SUPERSEDES:	

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PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

DEPARTMENT:

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PROGRAM OR P/N NO. HELICOPTER		PART NAME ASSEMBLE PIPE PLUGS & ALEMITE FITTINGS				ISSUE DATES 9-17-80			PART NO. D-651133-18-G					
FOR MODELS A119PHH GEAR REDUCER ASSEMBLY		MATERIAL		WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 1 OF 1		EXPENSE COST			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'T REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				
						TOTAL	BASIC	FREIGHT	INSTAL- LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
	PARTS REQUIRED:													
	(3) DETAIL #52 1/8" PIPE PLUG													
	(2) DETAIL #60 1/4" PIPE PLUG													
	(1) DETAIL #22 ALEMITE GREASE FITTING													
10	OBTAIN DET. #52 PIPE PLUGS, ASSEMBLE (3) PLUGS TO WORM GEAR HOUSING	GEAR REDUCER ASSEMBLY FIXTURE			.15									
20	OBTAIN DET. #60 PIPE PLUGS, ASSEMBLE (2) PLUGS TO MOTOR ADAPTER				10									
30	OBTAIN DET. #22 ASSEMBLE (1) FITTING TO WORM GEAR HOUSING				15									
TOTALS					SUB TOTAL OPER. 150								0.40	
REMARKS														
PROCESS ENGR. L. PALMER		PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:		OPER. NO.		
INDUSTR. ENGR.		LAB.	QUAL. CONTR.	PLT. ENGR.	PRODM.	DAILY PLT. PLANNING VOLUME		REQMTS. PC/HR. HRS.		SUPERSEDES:		150		

Mfg. Development  
Engrg. & Research

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PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

DEPARTMENT:

PROGRAM OR EPA NO. 106110SPAT		PART NAME SUB-ASSEMBLY MAGNET HOLDER TO REV. COUNTER ADAPTER				ISSUE DATES 9-17-80		PART NO. 531436							
FOR MODELS A LENGTH GEAR REDUCER ASSEMBLY		MATERIAL		WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 1 OF 1						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHINE REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTAL- LATION	TOTAL	DESIGN	BUILD	INST. TRNG./		
	PARTS REQUIRED:														
	(1) DETAIL #5 SLEEVE														
	(1) " #8 PC BOARD MOUNT														
	(1) " #9 PC BOARD														
	(1) " #10 ADJUSTER, PC BOARD														
	(2) " #49 SCREW														
	(2) " #50 FLAT WASHER														
	(2) " #51 LOCK WASHER														
	(1) " #52 NUT, JAM														
	(1) " #53 RETAINING RING														
	(1) " #54 SPRING														
	(1) " #55 DOWEL PIN														
10	POSITION DET. #5 SLEEVE, POSITION TO SUB-ASS'Y FIXTURE, DRIVE DET. #55 PIN TIRRO 1/8" DIA. HOLE	SUB-ASSEMBLY FIXTURE MALLET			.40										
20	POSITION DET. #9 PC BOARD TO DET. #8 MOUNT, SECURE WITH (2) DET. #49, 50 & 51 SCREWS, F/WASHERS & L/WASHERS	PNEUMATIC PISTOL GRIP SCREWDRTVER			.30										
30	PRE-ASSEMBLE DET. #52 NUT TO DET. #10 ADJUSTER, ASSEMBLE THRU SLEEVE AND DET. #54 SPRING, POSITION PC BOARD ASS'Y OVER DOWEL PIN & ADJUSTER, SECURE WITH DET. #53 RETAINING RING	MANUAL HAND TOOL			.75										
TOTALS		SUB TOTAL OPER. 160			1.45										
REMARKS															
Mfg. Development Engg. & Research		PROCESS ENGR. I. PALMER	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME	REQ'D. PER VEHICLE PC/NR.	NEXT ASSY: SUPERSEDES:	OPER. NO. 160					

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR PERN NO. MILITARY		PART NAME SUB-ASSEMBLY REV. COUNTER ADAPTER TO SLEEVE			ISSUE DATES 9-17-80		PART NO. 531436							
FOR MODELS ACMEPH GEAR REDUCER ASSEMBLY		MATERIAL			WT./ LBS.		RGH. FIN.		RELEASE		SHEET 1 OF 1			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTAL-LATION	TOTAL	DESIGN	BUILD	INST. BYG/PT	
	PARTS REQUIRED:													
	(1) SLEEVE SUB-ASSEMBLY (FROM PREV. OPER.)													
	(1) DETAIL #41 ADAPTER, REV. COUNTER													
	(AR) DETAIL #43 PERMATIX													
	(1) DETAIL #45 SCREW													
	(1) DETAIL #46 FLAT WASHER													
	(1) DETAIL #47 LOCK WASHER													
10	APPLY DET. #43 PERMATIX TO DET #46 ADAPTER	SUB-ASSEMBLY FIXTURE			.15									
		HAND BRUSH												
20	POSITION ADAPTER TO SLEEVE, SECURE WITH	PNEUMATIC PISTOL			.50									
	(1) DETAIL #45 SCREW,	GRIP SCREWDRIVER												
	(1) DETAIL #46 F/WASHER,													
	(1) DETAIL #47 L/WASHER													
30	REMOVE SLEEVE AND ADAPTER ASSEMBLY FROM FIXTURE, TRANSFER TO NEXT ASSEMBLY OPERATION				.15									
TOTALS						SUB-TOTAL OPER. 170						0.80		
REMARKS														
Mfg. Development		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	NATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
Engrg. & Research		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLY. PLANNING VOLUME	REQMTS.	SUPERSEDES:	170				
		I. PALMER						PC/NR.	NRS.					

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR CTR NO. HELICOPTAR		PART NAME ASSEMBLE MAGNET HOLDER TO WORM SHAFT				ISSUE DATES 9-17-80		PART NO. 531436							
FOR MODELS AZ119PH GEAR REDUCER ASSEMBLY		MATERIAL		WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 1 OF 1						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTAL- LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
	PARTS REQUIRED: (1) DETAIL #11 MAGNET HOLDER, REV. (1) DETAIL #48 SET SCREW	COUNTER													
10	OBTAIN DMT. #11 MAGNET HOLDER & DMT. #48 SET SCREW, POSITION MAGNET HOLDER TO WORM SHAFT IN GEAR REDUCER ASS'Y, SECURE WITH SET SCREW	GEAR REDUCER ASS'Y FIXTURE  HAND TOOL			.30										
TOTALS						0.30									
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR. I. PALMER	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME	REQ'D. PER VEHICLE PC/HR.	NEXT ASSY: SUPERSEDES:	OPER. NO. 180					

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PLANT FORD AEROSPACE

**PROCESS ESTIMATE SHEET**

DEPARTMENT: \_\_\_\_\_

PROGRAM OR CER NO. HRT10STAT	PART NAME ASSEMBLY REV. COUNTER ADAPTER/SLEEVE TO WORM HOUSING	ISSUE DATES 9-17-80	PART NO. 531436
FOR MODELS AZ110PM GEAR REDUCER ASSEMBLY	MATERIAL	WT./ LBS.	RGH. FIN.
		RELEASE	SHEET 1 OF 1

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'T REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. BYG/PT	
	PARTS REQUIRED: (1) REV. COUNTER ADAPTER/SLEEVE (FROM PREV. OPER.) (AR) DETAIL #43 PERMATEX (4) DETAIL #34 FLAT WASHER (4) DETAIL #35 LOCK WASHER (4) DETAIL #44 1/4-20 BOLT													
10	OBTAIN ADAPTER/SLEEVE SUB-ASSEMBLY AND APPLY DET. #43 PERMATEX	HAND BRUSH			.15									
20	POSITION ADAPTER/SLEEVE SUB-ASS'Y TO WORM GEAR HOUSING, SECURE WITH (4) DET. #34 FLAT WASHERS, (4) DET. #35 LOCK WASHERS & (4) DET. #44 BOLTS	GEAR REDUCER ASS'Y FIXTURE  PNEUMATIC PISTOL GRIP NUTRUNNER			.50									
<b>TOTALS</b>		SUB TOTAL OPER. 190			0.65									

REMARKS

PROCESS ENGR. L. PALMER	PLT. LAYOUT	AUTOMATION	DESIGN	NATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.
INDUSTR. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQ'TS. PC/HR. HRS.	SUPERSEDES:	190

*Hand* Mfg. Development  
Engrg. & Research

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR ECR NO. HELICOPTR	PART NAME ADJUST GAP BETWEEN MAGNET & IC'S	ISSUE DATES 9/17/80	PART NO. 531436
FOR MODELS AZ111111 GEAR REDUCER ASSEMBLY	MATERIAL	WT./LBS.	RGH. FIN.
		RELEASE	SHEET 1 OF 1

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REED.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYG./Y		
	PARTS REQUIRED: NONE														
10	ADJUST GAP BETWEEN MAGNET ON WORM SHAFT & IC'S (PC BOARD) USING .015" FEELER GAGE	GEAR REDUCER ASS'Y FIXTURE  HAND TOOL  FEEL GAGE			.30										
TOTALS															

SUB TOTAL OPER. 200

0.30

REMARKS

Mfg. Development Engrg. & Research	PROCESS ENGR.	PLY. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO. 200
	INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLY. ENGR.	PRODN.	DAILY PLY. PLANNING VOLUME	RECHTS. PC/HR. HRS.	SUPERSEDES	

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR ECR NO. HELICOPTAR		PART NAME ASSEMBLE COVER TO MOTOR REV. COUNTER			ISSUE DATES 9-17-80		PART NO. 531436							
FOR MODELS AZIMUTH GEAR REDUCER ASSEMBLY		MATERIAL			WT./ LBS.	RGH.	FIN.	RELEASE	SHEET 1	OF 1				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTAL- LATION	TOTAL	DESIGN	BUILD		INST. BY COST
	PARTS REQUIRED: (1) DETAIL #7 COVER, MOTOR REV. COUNTER (1) DETAIL #27 GASKET (4) DETAIL #45 10-32 SCREW (4) DETAIL #46 FLAT WASHER (4) DETAIL #47 LOCK WASHER													
10	OBTAIN DETAIL #7 COVER, DETAIL #27 GASKET POSITION GASKET & COVER TO MOTOR REV. COUNTER AND SECURE WITH (4) DET. #15 SCREW, (4) DET. #16 FLAT WASHER & (4) DET. #17 LOCKWASHER	GEAR REDUCER ASS'Y FIXTURE  PNEUMATIC PISTOL GRIP NUTRUNNER			.60									
20	REMOVE GEAR REDUCER ASS'Y FROM FIXTURE & TRANSFER TO NEXT ASSEMBLY OPERATION				.15									
TOTALS						0.75								
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR. I. PATMER	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. HDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME	REQ'D. PER VEHICLE REQ'TS. PC/HR. HRS.	NEXT ASSY. SUPERSEDES:				OPER. NO. 210	

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR ECM NO. HELICOPTR	PART NAME ASSEMBLE PINON TO END OF REDUCER SHAFT	ISSUE DATES 9-17-80	PART NO. D-651133-18-G
FOR MODELS AZIMUTH GEAR REDUCER ASSEMBLY	MATERIAL	WT./LBS.	RGH. FIN.
		RELEASE	SHEET 1 OF 1

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
	PARTS REQUIRED:													
	(1) DETAIL #30 PINON													
	(1) " #49 PINON KEY													
	(1) " #39 LOCKNUT													
10	OBTAIN GEAR REDUCER ASSY, POSITION IN FIXTURE, CLOSE CLAMP	ASSEMBLY FIXTURE			.25									
20	OBTAIN DET. #30 PINON, DET. #49 KEY & DET #39 LOCKNUT				.15									
30	POSITION KEY TO SLOT ON SHAFT & ASSEMBLE PINON	MANUAL			.20									
40	POSITION LOCKNUT TO END OF SHAFT & SECURE WITH HAND TORQUE WRENCH	HAND TORQUE WRENCH			.25									
50	TRANSFER GEAR REDUCER TO LINE OPERATION				.10									
TOTALS						0.95								
SUB TOTAL OPER. 220														

REMARKS

Mfg. Development Engrg. & Research	PROCESS ENGR. L. PALMER	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO. 220
	INDUST. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:	

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR CER NO. DET.TOTAP		PART NAME D. I. STANDARDS RECAP				ISSUE DATES 9/16/80		PART NO. D-651133-18-G							
FOR MODELS AC110PH GEAR REDUCER ASSEMBLY		MATERIAL				WT./ LBS.	RGM.	FIN.	RELEASE		SHEET 1 OF 1				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
10					1.10										
20					1.30										
30					.60										
40					.55										
50					.60										
60					1.45										
70					.75										
80					.80										
90					1.65										
100					.25										
110					.55										
120					.70										
130					.85										
140					.85										
150					.40										
160					1.15										
170					.80										
180					.30										
190					.65										
200					.30										
210					.75										
220					.95										
		SUB TOTAL			17.60										
		PERSONAL RELIEF			1.20										
TOTALS					18.80										
REMARKS															
		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
		INDUSTRIAL ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HRS. HRS.	SUPERSEDES:						

*Stew* Mfg. Development Engrg. & Research

PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR CTR NO. HML106PPAT		PART NAME FACILITY & TOOLING COST SUMMARY				ISSUE DATES 9-22-80		PART NO. D-651133-18-G							
FOR MODELS AC110PH GEAR REDUCER ASSEMBLY		MATERIAL				WT./ LBS.	RGH.	FIN.	RELEASE	SHEET 1 OF 1					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST		
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD		INST. TRYOUT	
	TOOLING & AIDS	BEARING PACKERS				21,000	15,000	1,000	5,000	25,000					
		ARBOR PRESSES													
		PNEUMATIC TOOLS													
		ASSEMBLY FIXTURES													
		BENCHES, STANDS													
		SPECIAL TOOLING													
		SERVICE RAIL WITH				13,000	8,000		5,000	5,000					
		AIR LINES & REGULATORS													
		LIGHTING				2,000	1,000		1,000						
		POWERED CONVEYOR	30			14,000	10,000	1,000	3,000	6,000					
		WITH ASSEMBLY													
		FIXTURES	12												
TOTALS						50,000				36,000					
REMARKS FLOOD SPACE 2,000 SQ. FT.															
PROCESS ENGR.		PLT. LAYOUT		AUTOMATION		DESIGN		MATH. MDLG. ENGR.		DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:	
INDUSTRIAL ENGR.		LAB.		QUAL. CONTR.		PLT. ENGR.		PRODN.		DAILY PLT. PLANNING VOLUME		REQMTS. PC/HR. HRS.		SUPERSEDES:	
Mfg. Development Eng. & Research						OHANESTAN									

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# AZIMUTH CODE WHEEL - 651133-104

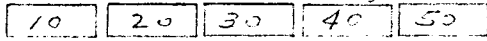
OFF LINE  
CUB-40011

START  
53193-5

SEALS - BEARINGS - WORM SLIT  
HOUSING

CAN-4

LINE STATION



60

WORM SLIT BEARINGS



90

2

MOTOR - MOTOR COUPLING



140

3

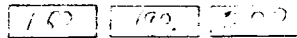
START 53193

PS BOARD & SLIT



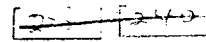
150

4



190

53193, START  
5



210

DELIVER TO  
OF AZIMUTH



2000

1B



10

PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR ECH NO. HRLI0STAT	PART NAME PLANETARY DRIVE ASSEMBLY	ISSUE DATES 4-23-80	PART NO. D-65113-18-B
FOR MOD 50,000/YEAR NET	MATERIAL	WT./ LBS.	RGH. FIN.
		RELEASE	SHEET 1 OF 7

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTAL-LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
		TWIN STRAND SLAT CONVEYOR												
10	FROM RACK P.U. & POS. THE BASE (#23) ON TO CONVEYOR	TROLLEY & BAL. HOISE SPECIAL HOIST HOOK			.25									
15	GAUGE BALL GROVE FOR COMPATIBLE MATCH OF BOTH PRIMARY & SECONDARY RING GEARS. MARK AS MATCHED SETS	SPECIAL GAUGING DEVICE			IND. LAB.					50,000				
20	P.U. & POS. #33 GASKET TO BASE - ALIGN IT TO THE BOLT HOLES				.20									
30	P.U. & POS. PRIMARY RING GEAR (#27) ONTO BASE - ALIGN HOLES	TROLLEY & BAL. HOIST			.40									
40	LOOSEN ASSEM 18 BOLTS (47) AND WASHERS THRU BASE FLANGE INTO PRIMARY RING GEAR				1.35									
50	SHUT TIGHT 18 BOLTS. SECURE TO REQUIRED TORQUE USING CRISS-CROSS PATTERN TO ASSURE UNIFORM POSITIONING OF RING GEAR TO BASE	SINGLE SPINDLE RIGHT ANGLE NUT RUNNER (ATR)			2.25									
	PERSONAL RELIEF				30									
TOTALS					4.75					50,000				

REMARKS

Mfg. Development Engrg. & Research	PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO. 10
	INDUSTR. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESTAN	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:	

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR CR NO. HELIOSTAT		PART NAME PLANETARY DRIVE ASSEMBLY				ISSUE DATES 4-24-80		PART NO. D-651133-18-B						
FOR MODELS 50,000/YEAR-NET		MATERIAL		WT./ LBS.	RGH.	FIN.	RELEASE	SHEET 2 OF 7						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACHS. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
10	APPLY OIL TO RING GEAR TEETH	APPLICATOR			.20	2,500	2,000		500	3,000				
20	FROM RACK P.U. PLANET GEAR & FRAME SUB ASSEMBLY & POS. TO BASE	TROLLEY & BALANCED			.35									
30	ENGAGE THE (3) PLANET GEARS WITH SPECIAL HAND TOOL AS THE SUB ASSEMBLY IS LOWERED TO ALIGN ALL OF THE GEAR TEETH	SPECIAL HAND TOOL WHICH INCLUDES A FUNCTIONAL DUPLICATE OF THE SUN GEAR			.25					3,000				
	NOTE: SLIGHT ROTATION OF PLANETS VIA THE HAND TOOL, WILL ALIGN BOTH RING GEARS AS THE PLANET SUB ASSEMBLY IS CAREFULLY LOWERED INTO THE DRIVE ASSEMBLY													
40	REMOVE HOISE HOOKS				.10									
50	CHECK ROTATION WITH HAND TOOL - REMOVE HAND TOOL				.15					500				
60	CHECK COMPLETE ROTATION OF PLANET FRAME WITH TORQUE BAR	HAND TOOL			.25					500				
	PERSONAL RELIEF				.10									
TOTALS						1.40	2,500			7,000				
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	RECHTS.	SUPERSEDES:	20				
							PC/HR.	HRS.						

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR ECR NO. HELIOSTAT		PART NAME ASSEM. BEARING BALLS & SECONDARY RING GEAR				ISSUE DATES 9-16-80		PART NO. D-651133-18-B						
FOR MODELS 50,000/YEAR-NET		MATERIAL		WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 3 OF 7					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD		INST. BYG/PT
10	POS. SPACER TABS ON TO TOP SURFACE OF PRIMARY RING GEAR	SPACER TABS	3		.30					1,000				
20	SELECT MATCHED SECONDARY RING GEAR (28). P.U. WITH HOIST - TRANSFER AND POS. ONTO SPACER TAB ON PRIMARY RING GEAR REMOVE HOIST & HOOK ADAPTOR	HOTST HOOK ADAPTOR			.35	4,000	1,000	1,000	2,000					
30	POSITION BALL DELIVERY TUBE TO BALL DELIVERY PORT OF PRIMARY RING GEAR. SELECT BALL SIZE DISPENSER ACCORDING TO GAUGED SIZE OF MATCHED RING GEARS	SEMI-AUTOMATIC BALL FEEDER SYSTEM			.50	14,000	2,000	2,000	10,000	150,000				
40	ATTACH SPECIAL POWERED ROTATING DEVICE TO SECONDARY RING GEAR	SPECIAL ROTATING TOOL OF APPROX. 2 OR 3 RPM			.40									
50	ACTIVATE BOTH ROTATING DEVICE AND BALL DISPENSER & MONITOR OPERATION DURING FILLING				1.50									
60	DEBENGAGE DISPENSER & ROTATION DEVICE & SPACER TABS				.30									
70	P.U. "O" RING (40) & RETAINING BOLT (37) & ASSEM. TO PORT TO SPECIFIED TORQUE	SINGLE SPINDLE NUT RUNNER - TORQUE CONTROL			.45									
	PERSONAL RELIEF				4.05									
TOTALS						18,000				151,000				
REMARKS														
Mfg. Development Engr. & Research		INDUSTR. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLY. PLANNING VOLUME	REQ'D. PER VEHICLE	PC/HR.	HRS.	NEXT ASSY:	SUPERSEDES:		OPER. NO. 30

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FORD AEROSPACE

PROCESS ESTIMATE SHEET

PLANT		PROGRAM OR EPR NO. HELICOSTAT				PART NAME PLANETARY DRIVE ASSEMBLY				ISSUE DATES 4-24-80		DEPARTMENT					
FOR MODELS 50,000/YEAR-NET		MATERIAL				WT./LBS.		RGH.		FIN.		PART NO. D-651133-18-B		RELEASE		SHEET 4 OF 7	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST			
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT				
10	APPLY LUBRICANT TO UPPER-OUTER EDGE OF SECONDARY RING GEAR // (28) TO EASE THE ASSEMBLY OF // (41) SEAL	APPLICATOR			.50					3,000							
20	P.U. & POS. SEAL // (41)				1.00												
30	APPLY OIL TO SEAL & BEARING SURFACE OF FRAME				.25												
40	VACUUM CLEAN INGLIDE OF ASSEMBLY	HEAVY DUTY VACUUM CLEANER			.75					1,500							
50	P.U. & POS. (4) ALIGNMENT PINS TO SECONDARY RING GEAR (28)				.40												
60	P.U. & POS. GASKET // (34)				.50												
70	P.U. & POS. COVER // (24) ON TO ASSEMBLY & PINS	HOIST															
80	REMOVE ALIGNMENT PINS AND HAND START (4) BOLTS (46)				.40												
90	RUN-DOWN & TORQUE BOLTS	1-SPINDLE AIR TOOL AND BALANCER			.30												
100	START & TORQUE PIPE PLUG // 51	HAND TOOL			.15												
	PERSONAL RELIEF				.30					500							
TOTALS					4.55					5,000							
REMARKS																	
Mfg. Development Engr. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO. 40							
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:								

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PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

DEPARTMENT:

PROGRAM OR P/R NO. HELIOSTAT		PART NAME PLANETARY DRIVE ASSEMBLY				ISSUE DATES 4-24-80		PART NO. D-651133-18-B						
FOR MODELS 50,000 YEAR NET		MATERIAL		WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 5 OF 7					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INIT. TRYOUT	EXPENSE COST
10	FILL THE GEAR BOX WITH A METERED AMOUNT OF GEAR LUB.	RESERVOIR WITH METERING PUMP	1		1.00	3,500	3,000		500	2,000				
20	P.U. & POS. DOUBLE WORM REDUCER S/A AND ENGAGE SUN GEAR TO THE (3) PLANET GEARS	MANUAL			.40									
30	ALIGN (4) BOLT HOLES START (4) #45 #54 BOLT & WASHER	MANUAL			.30									
40	RUN DOWN (4) BOLTS TO TORQUE	1-SPINDLE ATR TOOL & BALANCER			.30									
50	OBTAIN GIBBAL HOUSING, POSITION TO BASE COVER, LOOSE ASSEMBLE (12) DET. #55 LOCKWASHER (12) DET #61 BOLTS, (12) DET #63 SPACERS, SECURE WITH POWER TOOL	PNEUMATIC RT. ANGLE NUTRUNNER			2.35									
60	FUNCTIONAL TEST				IND LAB					5,000				
70	TRANSFER TO PAINT				IND LAB									
TOTALS					4.35	3,500				7,000				
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTRY ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:	50				

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

10

PROGRAM OR EER NO. D651133-18-B		PART NAME FACILITY & TOOL COST SUMMARY				ISSUE DATES 9/17/80			DEPARTMENT PART NO. D-651133-18-B					
FOR MODELS 90,000 YEAR NET		MATERIAL		WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 6 OF 7					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD		INST. FY/QT
	TOOLING & ATDS	HAND & POWER TOOLS	LOT			10,000	5,000		5,000	15,000				
		TWIN SLAT POWERED CONVEYOR 40 FEET LONG	1			42,000	36,000	1,000	5,000					
		TOOL RACKS WITH AIR LINES, REGULATORS, DRIERS, LUBRICATORS & BALANCERS (50 FT.)				10,000	5,000		5,000	10,000				
		ASSEMBLY FIXTURES TO BE ATTACHED ON ASSEMBLY CONVEYOR ON 4 FOOT CENTERS	16			6,000	2,000	1,000	3,000	30,000				
		SECONDARY LIGHTING				2,000	1,000		1,000					
TOTALS						70,000				55,000				
REMARKS FLOOR SPACE = 2,500 SQ. FT. TOTAL: FAC - 94,000 TOOL- 276,000 370,000														
		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. HDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTY. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESIAN	PRODN.	DAILY PLY. PLANNING VOLUME	REQMYS. PC/NR. HRS.	SUPERSEDES:	ALL				
Mfg. Development Engrg. & Research														

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PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

DEPARTMENT:

PROGRAM OR ECR NO. HRL105747	PART NAME PLANETARY DRIVE ASSEMBLY	ISSUE DATES	PART NO. D-651133-18-B
FOR MODELS AZIMUTH DRIVE ASSEMBLY	MATERIAL DIR. LAB. STDS. RECAP	WT./ LBS.	RGH. FIN.
		RELEASE	SHEET 7 OF 7

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRVCT	
10					4.75									
20					1.40									
30					4.05									
40					4.55									
50					4.35									
					19.10									
	PERSONAL RELIEF				1.30									
<b>TOTALS</b>					20.10									

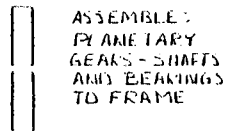
REMARKS

	PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.
	INDUSYR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODM.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:	ALL

*Flow* Mfg. Development  
Engrg. & Research

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PLANETARY GEAR  
AND FRAME  
ASSEMBLY



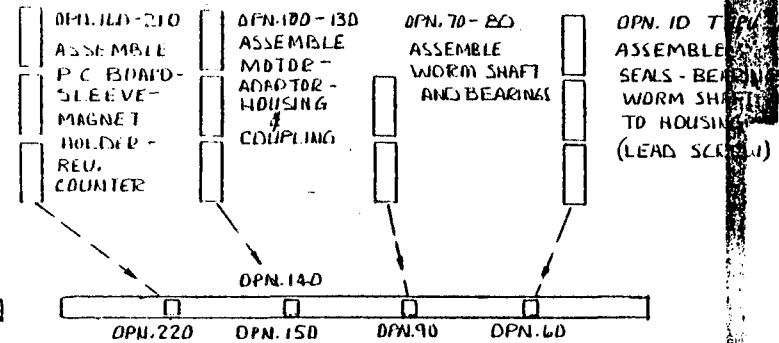
ASSEMBLE  
PLANETARY  
GEARS - SHAFTS  
AND BEARINGS  
TO FRAME

DELIVER TO:  
STATION 2  
AZIMUTH  
ASSEMBLY

AZIMUTH GEAR REDUCER ASSEMBLY

SUB-ASSY - 581436

SUB-ASSEMBLY - 651133-186



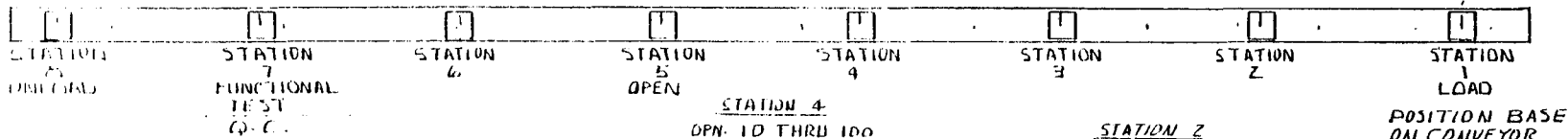
DELIVER TO  
STATION 6  
AZIMUTH  
ASSEMBLY

STATION 5  
REMOVE ASSEMBLY  
FROM CONVEYOR  
PLACE ON MATERIAL  
HANDLING RACK  
DELIVER TO  
FUNCTIONAL OPERATION

STATION 6  
OPN. 10 THRU 70  
FILL WITH LUB. OIL  
INSTALL WORM REDUCER  
INSTALL BOLTS  
TORQUE DOWN BOLTS  
POSITION & BOLT DOWN  
GIMBAL HOUSING

STATION 3  
OPN. 10 THRU 70  
POSITION SPACER TABS  
INSTALL SECONDARY  
RING GEAR  
POSITION BALL FEEDER  
DEVICE  
ATTACH CLAK DRIVER  
START ROTATION & BALL FEEDER  
FEED IN 65 BALLS & 65 SPACERS  
DISENGAGE SYSTEM  
ASSEMBLE TO RING & BOLT

STATION 1  
OPN. 15 THRU 50  
GANGE BALL GROOVE  
INSTALL GASKET  
POSITION RING GEAR  
INSERT START &  
TIGHTEN 18 BOLTS



STATION 4  
OPN. 10 THRU 100  
CLEAN HOUSING INTERIOR  
LUBRICATE RING GEAR  
INSERT ALIGNMENT PINS  
POSITION GASKET  
POSITION COVER  
REMOVE PINS  
INSTALL & TIGHTEN BOLTS  
INSTALL PLUG

STATION 2  
OIL RING GEAR  
INSTALL PLANET  
GEAR ASSEMBLY

AZIMUTH DRIVE ASSEMBLY

PLANETARY GEAR ASSEMBLY  
GEAR REDUCER ASSEMBLY  
AREA = 5,300 sq. ft.

J. DHANESIAN 9-22-80



PROCESS ESTIMATE SHEET

PLANT		PART NAME		ISSUE DATES		DEPARTMENT									
PROJECT OR ECR NO. HELIOSTAT		HOUSING - WORM GEAR		9-9-80		PART NO. C-790234									
FOR MODELS AZIMUTH DRIVE ASSEMBLY		MATERIAL NOD. IRON CASTING		WT./ LBS.		RGH. FIN.									
						RELEASE									
						SHEET 1 OF 4									
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRNG		
05	RECEIVE CASTINGS														
10	ROUGH & FIN. TURN 2.247/ 2.243 DIA. & ADJACENT MOUNTING FACES - CORE DRILL 1.655 DIA. BORE BEST. F. TO F. - 3.0 MIN.	AUTO. TURRET LATHE -10" SWING MIN.  GAGES	1	13	3.75	143,000	130,000	3,000	10,000	30,000					
										6,000					
20	DRILL (4) .406 DIA. MTG HOLES & BEAM (1) FOR MFG PURPOSES BEST. F. TO F. - 1.0 MIN.	VERT. DRILL PRESS W/MULTIPLE SPINDLE  GAGES	1	38	1.25	55,000	50,000	1,000	4,000	12,000					
										2,000					
30	CORE DRILL & SEMI-FIN BORE (2) 1.875, 2.752 & 2.4416 BORE DIA.S (CYCLE RUN BY CHANGING TOOLS BEST. CHANGE-OVER = 1.0 HOUR BEST. F. TO F. - 3.0 MIN.	SPEC. (3) WAY DRILL MACH.  GAGES	1	13	3.75	165,000	150,000	3,000	12,000	30,000					
										3,000					
TOTALS						363,000				83,000					
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR. H. GOVE	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
		INDUSTR. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESIAN	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. 13PC/HR. 16 HRS.	SUPERSEDES:						

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PROCESS ESTIMATE SHEET

PROGRAM OR CR NO.		PART NAME		ISSUE DATES		DEPARTMENT								
HELIOSTAT		HOUSING - WORM GEAR		9-9-80		C-790234								
FOR MODELS		MATERIAL		WT./	RGH.	FIN.	RELEASE	SHEET	OF					
AZIMUTH DRIVE ASSEMBLY				LBS.				2						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'Y REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
40	DRILL & TAP (12) 1/4-20 HOLES IN (3) SURFACES & (3) 1/8 PIPE TAPS IN (2) SURFACES	SPEC. (5) STA. SHUTTLE DRILL & TAP MACH.	1	15	3.15	305,000	280,000	5,000	20,000	80,000				
	EST. F. TO F. - 2.5 MIN.	GAGES								6,000				
50	FIN. BORE 1.8755, & SEMI-FIN., 2.4416 & 1.655 BORES & GENERATE FACES	SPEC. (3) WAY PREC. BORE MACH.	1	30	1.67	250,000	230,000	3,000	17,000	60,000				
	EST. F. TO F. - 1.3 MIN.	GAGES								30,000				
60	PRESS IN BUSHINGS INTO (2) 1.8755 DIA. BORES	HYD. PRESS	1		0.40	11,100	10,000	100	1,000	4,000				
70	FIN. ALL BORES & FACES	FROM OPER. 50		30	1.62					20,000				
	EST. F. TO F. - 1.3 MIN.	GAGES								3,000				
	EST. CHANGE-OVER - (1) HOUR													
TOTALS						566,100				203,000				
REMARKS														
Mfg. Development Engg. & Research		INDUSTR. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
							DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:					

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PROCESS ESTIMATE SHEET

PLANT		PROGRAM OR ECR NO.					PART NAME			ISSUE DATES		DEPARTMENT			
		AZIMUTH DRIVE ASSEMBLY					HOUSING - WORM GEAR			9-9-80		C-790234			
		MATERIAL					WT. / LGH. FIN.			9-9-80		RELEASE		SHEET 3 OF	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S RECD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
75	✓ JASH					Avail.									
80	FINAL INSPECT & TRANS-PORT TO GEAR ASSY.	GAGES								20,000					
	PERSONAL RELIEF				1.04										
TOTALS					16.63					20,000					
REMARKS															
PROCESS ENGR. H. GOVE INDUSTYR. ENGR.		PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO.					
Mfg. Development Engrg. & Research		LAB.	QUAL. CONTR.	PLT. ENGR.	PRODM.	DAILY PLT. PLANNING VOLUME	REQMTS. 13 PC/NR. 16 HRS.	SUPERSEDES:							

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PROCESS ESTIMATE SHEET

PROGRAM OR PROJ. NO.		PART NAME		ISSUE DATES			DEPARTMENT							
HELIOSTAT		HOUSING - WORM GEAR		9-9-80			C-790234 A							
FOR MODELS		MATERIAL		WT./	RGH.	FIN.	RELEASE	SKETCH	CF					
AZIMUTH DRIVE ASSEMBLY		PLANT ENGINEERING REQUIREMENTS		LBS.				4	4					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. COST	
1	CHIP - COOLANT AND CLARIFICATION SYSTEMS					93,000	60,000	3,000	30,000					
2	COOLANT REFRIGERATION SYSTEM													
3	EXHAUST - FUME - DUST AND VENTILATION													
4	GCP FIRE PROTECTION SYSTEM													
5	MONORAIL CONVEYERS					80,000	40,000		40,000					
6	MONORAIL CARRIERS (COOLING)									5,000				
7	ROLLER CONVEYER					7,700	5,000	200	2,500					
8	POWERED CONVEYERS													
9	PLATFORMS - STILES													
10	SERVICE RAILS AND HOISTS													
11	TOOL CABINETS - RACKS AND STANDS					2,000	1,000		1,000					
12	TOOL CONTROL CARDS													
13	WORK - GAGING AND INSPECTION TABLES					4,000	2,000		2,000				4,000	
14	PARTS BASKETS (EXPENSE)												4,000	
15	PRODUCTION AIDS - ASSEMBLY AIDS													
16	SECONDARY LIGHTING													
17	PROGRAMMABLE CONTROLLERS													
18	AUTOMATION - PART HANDLING SYSTEM													
19	ENGINEERING SERVICES DESIGN - (EXPENSE)												10,000	
20	BUILDING SERVICES - UTILITIES													
21	POWER AND FREE CONVEYOR SYSTEM													
22	POWER AND FREE CONVEYOR CARRIERS (COOLING)													
23	MACHINE FOUNDATIONS AND DECKS													
24	PLANT REARRANGEMENT (EXPENSE)													
25	MATERIALS HANDLING - RACKS - CONTAINERS - DORAGE					2,000	3,000							
BUILDING CONSTRUCTION		2800 SQ. FT.								5,000				14,000
TOTALS						188,700				5,000				14,000

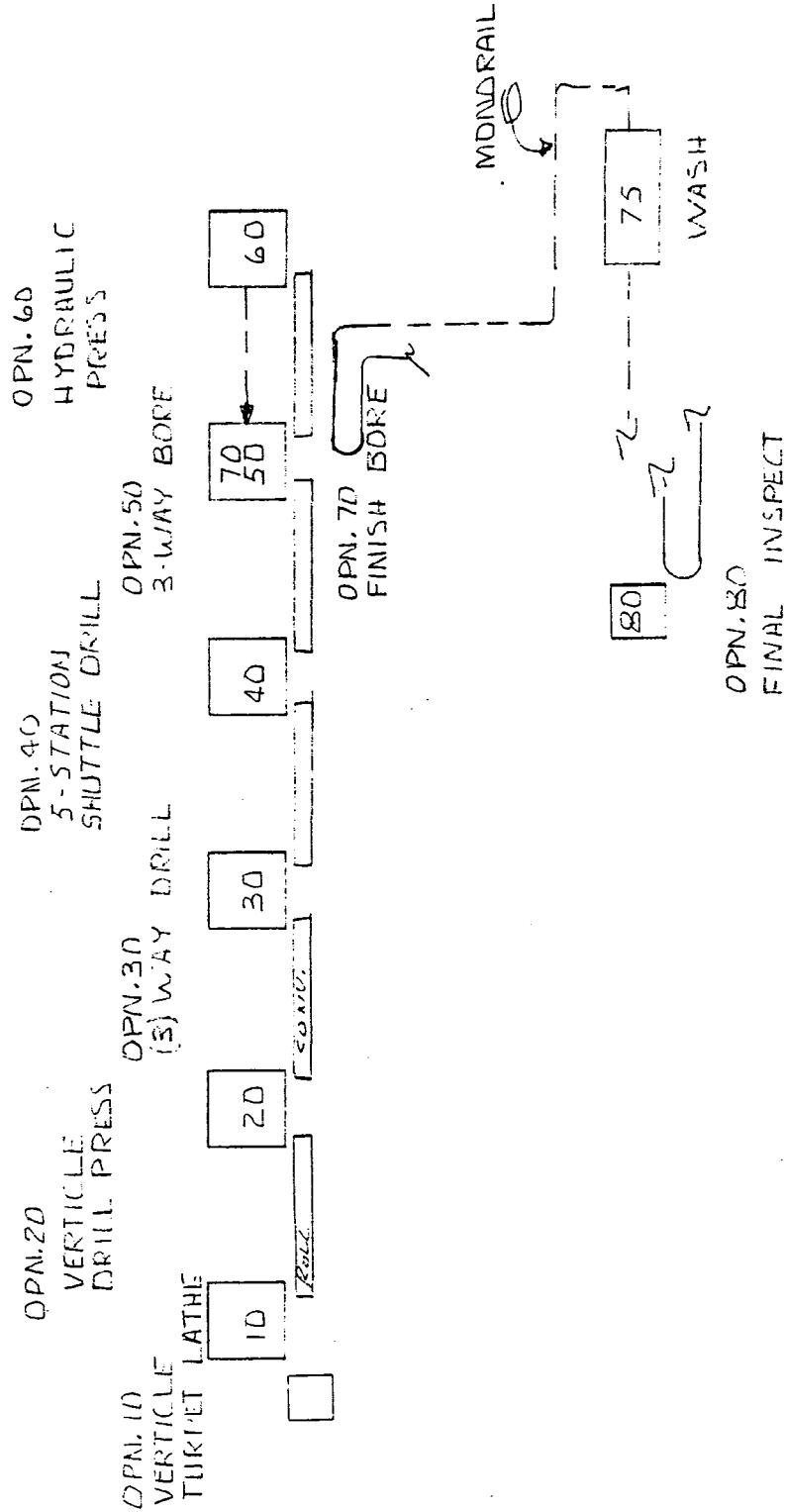
REMARKS TOTALS: FAC. - 1,117.8 )  
 TOOLG - 331 ) 1,442.8  
 14 )

188,700

PROCESS ENG.	PLT. LAYOUT	AUTOMATION	DESIGN	INST. ADLS. ENGR.	DAILY SERVICE	REQ. PER VEHICLE	REPT. ASST.
PLANT ENG.	PLT. ENGR.	PLANT ENGR.	PLT. ENGR.	PLANT ENGR.	DAILY PLT. PLANNING	FREIGHT	REQUIREMENTS

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2



SQUARE FLEET - 2,800  
HOUSING - WORM GEAR  
C-790234

PLANT

D651133-18 DETAIL 2

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR CTR NO. HELIOSTAT		PART NAME HIGH SPEED CAP OPEN			ISSUE DATES 9-11-80		DEPARTMENT PART NO. B800240								
FOR MODELS AZIMUTH DRIVE ASSEMBLY		MATERIAL C1117-STEEL			WT./ LBS. 3.21 FIN.		RELEASE 3-11-80 SHEET 1 OF 5								
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			SUPERSEDE COST		
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD		INST. TRYOUT	
5	RECEIVE BAR STOCK 2.9 DIA				IND. LAB										
10	CHUCK ON O.D. - CUT OFF BLANKS TO ROUGH SIZE	POWER HACK SAW	1	14	3.43	11,200	10,000	200	1,000	500					
	MCT = 2.58 MIN/PC 140 STROKES/MIN. 4 PITCH BLADE .009 INCHES/STROKE														
TOTALS						11,200				500					
REMARKS															
PROCESS ENGR. J. CALHOUN		PLT. LAYOUT LAB.		AUTOMATION QUAL. CONTR.		DESIGN PLT. ENGR. OHANENSIAN		MATH. MDLG. ENGR. PRODN.		DAILY SERVICE 50,000 PER YR. DAILY PLT. PLANNING VOLUME 208		REQ'D. PER VEHICLE ONE 13 PC/HR. 16 HRS.		NEXT ASSY: SUPERSEDES:	OPER. NO.

*Stw* Mfg. Development  
Engrg. & Research

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PLANT \_\_\_\_\_

DG51133-18 Detail 2

PROCESS ESTIMATE SHEET

DEPARTMENT \_\_\_\_\_

PROGRAM OR CEA NO. HELIOSTAT	PART NAME HIGH SPEED CAP OPEN	ISSUE DATES 9-15-80	PART NO. B800240
FOR MODELS AZ10011 DRIVE ASSEMBLY	MATERIAL C1117 STEEL	WT./ LBS.	RGH. 3.21
		FIN.	RELEASE 3-11-80 SHEET 2 OF 5

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S RECD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. (BYG/2)	
20	CHUCK ON O.D. - FACE ONE END. DRILL PILOT HOLE. DRILL 1.12 HOLE. BORE 1.35 COUNTER BORE. ROUGH 1.57 DIA. HOLE. ROUGH CUT O.D. STEP  MCT = 1.72 MIN/PC	5" TURRET LATHE	1	22	2.18	88,000	80,000	2,000	6,000	7,000				
30	FINISH TURN O.D. STEP FINISH BORE 1.2 DIA. 1.57 DIA HOLE. FINISH FACE FLANGE  MCT = .56 MIN/PC  30 MINUTE CHANGE OVER	TURRET LATHE	1	68	.71	USE DETAIL	20 MACHINE							
<b>TOTALS</b>						88,000				7,000				

REMARKS \_\_\_\_\_

	PROCESS ENGR. J. CALHOUN	PLT. LAYOUT LAB.	AUTOMATION	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PRODM.	DAILY SERVICE 50,000 PER YEAR DAILY PLT. PLANNING VOLUME 208	REQ'D. PER VEHICLE ONE REQMTS. 13 PC/HR. 16 HRS.	NEXT ASSY: SUPERSEDES:	OPER. NO.
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*Stow* Mfg. Development  
Engrg. & Research

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PLANT

D651133-18 DETAIL 2

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR ECA NO. HELIOSTAT	PART NAME HIGH SPEED CAP OPEN	ISSUE DATES 9-15-80	PART NO. B800240A
FOR MODELS AZIMUTH DRIVE ASSEMBLY	MATERIAL C1117 STEEL	WT./ LBS. 3.21	RELEASE 3-11-80 SHEET 3 OF 5

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTAL-LATION	TOTAL	DESIGN	BUILD	INST. TRVCT	
40	LOCATE ON INSIDE OF FLANGE FACE OTHER END, CUT RIGH GROOVES  MCT = .67 MIN/PC	BORING MACHINE	1	57	.84	68,000	67,000	1,000	5,000	20,000				
50	LOCATE FROM CENTER BORE DRILL (4) BOLT HOLES .281 DIAMETER  .75 MIN/PC	DRILL PRESS DRILL FIXTURE W/BUSHINGS	1	51	.94	21,000	19,000	500	1,500	3,000				
<b>TOTALS</b>						89,000				23,000				

REMARKS

PROCESS ENGR. J. CALHOUN	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE 50,000 PER YR.	REQ'D. PER VEHICLE ONE	NEXT ASSY:	OPER. NO.
INDUST. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME 208	REQMTS. 13 PC/HR. 16 HRS.	SUPERSEDES:	

Stow Mfg. Development Engrg. & Research

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PLANT

D651133-18 Detail 2

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR ECR NO. HELIOSTAT	PART NAME HIGH SPEED CAP OPEN	ISSUE DATES 9-15-80	PART NO. 8800240
FOR MODELS AZ1100TH DRIVE ASSEMBLY	MATERIAL C1117 STEEL	WT./LBS. 3.21	RGH. FIN. 3.21
		RELEASE 3-11-80	SHEET 4 OF 5

3

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRVCT	
60	MOUNT IN V' BLOCK FIXTURE, LOCATE FROM BOLT HOLES, MILL 30° ANGLE 2 1/4" END MILL	MILLING MACHINE	1	45	1.07	27,600	25,000	500	2,000	3,000				
	NCT = .85 MIN/PC													
70	FINAL INSPECTION	GAGES AND BENCH			IND. LAB					5,000				
	PERSONAL RELIEF				.61									
TOTALS					9.78	27,600				8,000				

REMARKS

PROCESS ENGR. J. CALHOUN	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE 50,000 PER YR. DAILY PLT. PLANNING VOLUME 208	REQ'D. PER VEHICLE ONE REQMTS. 13 PC/HR. 16 HRS.	NEXT ASSY: SUPERSEDES.	OPER. NO.
Mfg. Development Engrg. & Research								

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**PROCESS ESTIMATE SHEET**

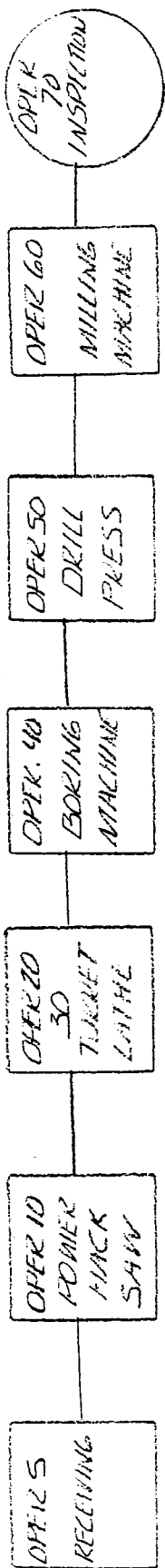
PLANT		<b>PROCESS ESTIMATE SHEET</b>						DEPARTMENT						
PROGRAM OR CER NO. HELIOSTAT		PART NAME HIGH SPEED CAP OPEN				ISSUE DATES 9-17-80		PART NO. B-800240						
FOR MODELS AZIMUTH DRIVE ASSEMBLY		MATERIAL PLANT ENGINEERING REQUIREMENTS		WT./ LBS.	RGH.	FIN.	RELEASE	SHEET	5	OF	5			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRVCS	
1.	CHIP - COOLANT AND CLARIFICATION SYSTEMS					77,500	50,000	2,500	25,000					
2.	COOLANT REFRIGERATION SYSTEM													
3.	EXHAUST - FUME - DUST AND VENTILATION													
4.	CO2 FIRE PROTECTION SYSTEM													
5.	MONORAIL CONVEYORS	200'				40,000	20,000		20,000					
6.	MONORAIL CARRIERS (TOOLING)	4' @ 50 x 100								5,000				
7.	ROLLER CONVEYOR 15 x 5 x 75					6,500	4,000	500	2,000					
8.	POWERED CONVEYORS													
9.	PLATFORMS - STILES													
10.	SERVICE RAILS AND HOISTS													
11.	TOOL CABINETS - RACKS AND STANDS					2,000	1,000		1,000					
12.	TOOL CONTROL BOARDS													
13.	WORK - GAGING AND INSPECTION TABLES					4,000	2,000		2,000					
14.	PARTS BASKETS (EXPENSE)	16 ÷ 208 x 3 = 40 x 50												2,000
15.	PRODUCTION AIDS - ASSEMBLY AIDS													
16.	SECONDARY LIFTING													
17.	PROGRAMMABLE CONTROLLERS													
18.	AUTOMATION - PART HANDLING SYSTEM													
19.	ENGINEERING SERVICES DESIGN (EXPENSE)													2,000
20.	BUILDING SERVICES - UTILITIES													
21.	POWER AND FREE CONVEYOR SYSTEM													
22.	POWER AND FREE CONVEYOR CARRIERS (TOOLING)													
23.	MACHINE FOUNDATIONS AND DECKS													
24.	PLANT REARRANGEMENT (EXPENSE)													
25.	MATERIALS HANDLING - RACKS - CONTAINERS - DUNNAGE					3,000	2,000		1,000					
BUILDING CONSTRUCTION		2800 SQ. FT.												
<b>TOTALS</b>						133,000				5,000				4,000
REMARKS: TOTALS: FAC. - 348,800 TOOLG - 43,500 } 396,300 EXP. - 4,000														
	PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
	INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR. DIANESEAN	PRODN.	DAILY PLT. PLANNING VOLUME	REQMYS. PC/HRS. HRS.	SUPERSEDES:						

*Stnd* Mfg. Development Engrg. & Research

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③

PROCESS SEQUENCE FOR  
HIGH SPEED CAP - OPEN  
D651133-18 DETAIL Z  
WINSMITH NO. B800240



APP A = 2800 SJ.FT.

**PROCESS ESTIMATE SHEET**

PLANT FORD AEROSPACE

DEPARTMENT: \_\_\_\_\_

④

PROGRAM OR ECR NO. HELFOSTAT	PART NAME SLOW SHAFT COVER	ISSUE DATES 9-16-80	DEPARTMENT B 800 241
FOR MODELS MULTI DRIVE ASSEMBLY	MATERIAL CAST IRON	WT./ LBS. 2.812	RELEASE 3-11-80 SHEET 1 OF 4

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD		INST. TRNGT
5	RECEIVE CASTINGS	INSPECTION ROCKWELL OR BRINELL HARDNESS CHECKER			IND. LAB									
10	CHUCK ON O.D. ROUGH TURN AND FACE ROUGH BORE & COUNTERBORE ROUGH BORE DIA A.  MKT = 1.25 MTN/PC	5" TURRET LATHE	1	30	1.60	88,000	80,000	2,000	6,000	12,000				
	PERSONAL RELIEF				.16									
<b>TOTALS</b>					7.37	88,000				12,000				

REMARKS

Mfg. Development Engrg. & Research	PROCESS ENGR. J. CALHOUN	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE 50,000 PER YR.	REQ'D. PER VEHICLE ONE	NEXT ASSY:	OPER. NO.
	INDUSTY. ENGR.	LAW.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME 208	REQMTS. 13 PC/HR. 16 HRS.	SUPERSEDES.	

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PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR CTR NO. HELICOPTER		PART NAME SLOW SPEED COVER			ISSUE DATES 9-16-80		PART NO. B-800241							
FOR MODELS AZ100PH DRIVE ASSEMBLY		MATERIAL CAST IRON		WT./ LBS.	RGH.	FIN.	RELEASE 3-11-80		SHEET 2 OF 4					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD		INST. BY QTY
20	TURN CASTING OVER LOCATE ON ID CHUCK ON OD - TURN AND FACE OTHER SIDE. (ROUGH & FINISH) MCT = 1.10 MIN/PC	VERTICAL TURNING MACHINE	1	34	1.41	74,000	68,000	1,000	5,000	30,000				
30	LOCATE FROM ID DRILL .33 DIAMETER HOLE 1.2 CP MCT = .62 MIN/PC	DRILL PRESS	1	61	.79	22,000	20,000	500	1,500	2,000				
40	TAP 1/8 NPT (27 TPI)	DRILL PRESS W/ TAPPING LEAD	1	109	.44	27,500	25,000	500	2,000	2,000				
TOTALS						123,500				34,000				
REMARKS														
Mfg. Development Engr. & Research		PROCESS ENGR. J. CATHOUN	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE 50,000 PER YR	REQ'D. PER VEHICLE ONE	NEXT ASSY:		OPER. NO.			
		INDUSTY. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME 208	REQYTS. 13 PC/HR. 16 HRS.	SUPERSEDES:					

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PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

DEPARTMENT:

PROGRAM OR PFR NO. HELIOSTAT		PART NAME SLOW SPEED COVER				ISSUE DATES 9-16-80		PART NO. B 800241						
FOR MODELS AZIMUTH DRIVE ASSEMBLY		MATERIAL CAST IRON		WT./ LBS.	RGH. 2.812	FIN.	RELEASE 3-11-80		SHEET 3 OF 4					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD		INST. TRNG/PT
50	DRILL (4) .281 DIA. HOLES MCP = .85 MIN/PC	DRILL PRESS	1	45	1.07	AVAILABE	PROM OI	.30		2,000				
60	CHUCK ON 2.6 DIA LOCATE ON FACE, FINISH TURN O.D.S (2), FINISH FACE FIDEN BORE 1.655 AND DIAMETER A MCP = 1.25 MIN/PC 1.2 HR CHANGE OVER	TURNING MACHINE	1	30	1.60	AVAILABE	FROM OI	20		20,000				
70	FINAL INSPECTION	GAGES			IND. LAB					6,000				
TOTALS										28,000				
REMARKS														
PROCESS ENGR. J. CATHOUN		PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE 50,000 PER YR	REQ'D. PER VEHICLE ONE	NEXT ASSY:		OPER. NO.				
INDUSTR. ENGR.		LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLY. PLANNING VOLUME 208	REQTS. 13 PC/HR.	16 HRS.		SUPERSEDES:				

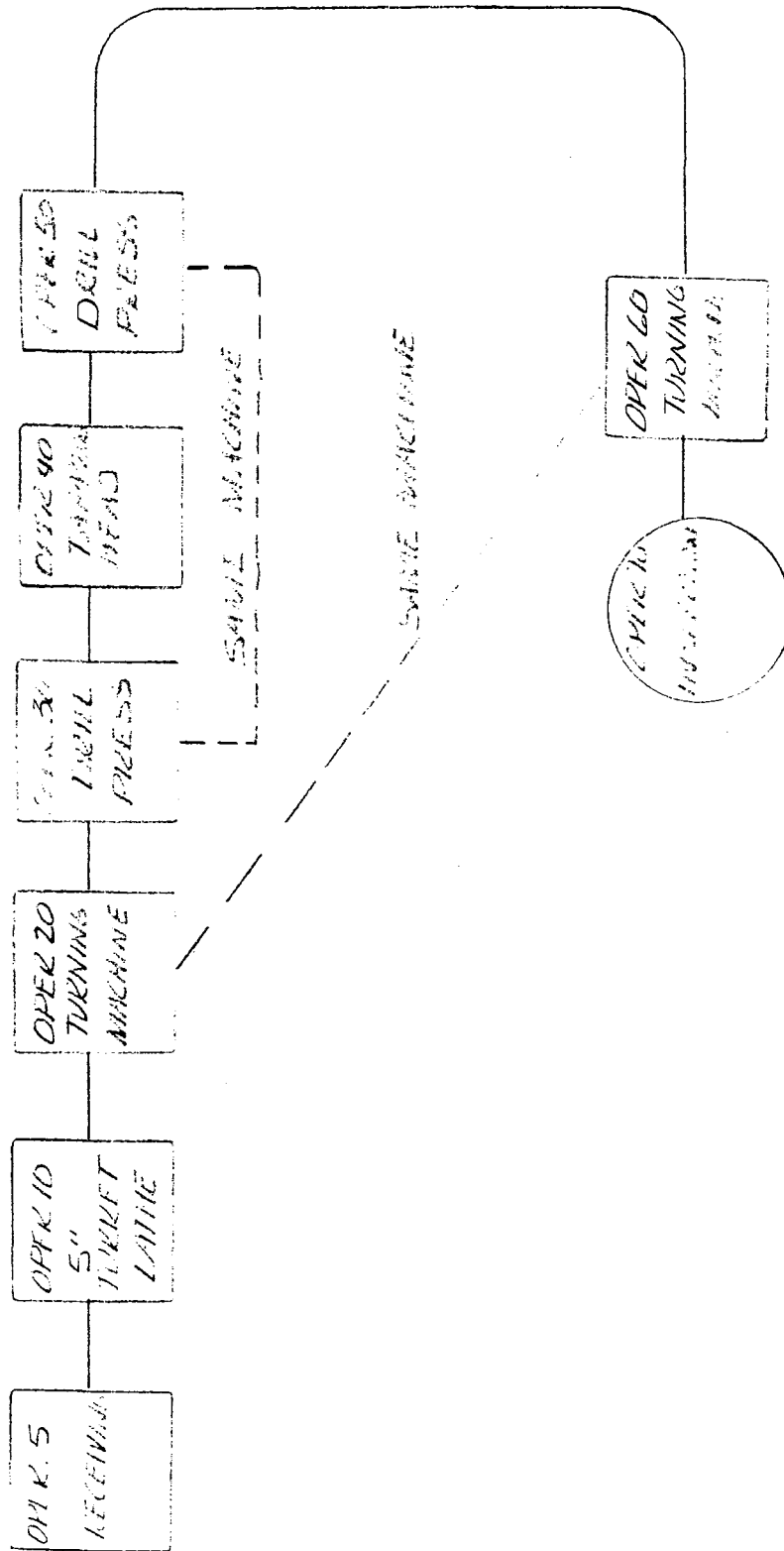
Mfg. Development Engrg. & Research

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(H)

PROCESS SEQUENCE FOR  
D6 51133-14 LYTAL 5  
MINI-SMITH AND BARRETT



AREA = 1600 SQ. FT.



PLANT

D651134-18 DETAIL 5

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR ECR NO. HELIOSTAT	PART NAME SLOW SPEED SHAFT	ISSUE DATES 9-12-80	PART NO. 8830234
FOR MODELS AZIMUTH DRIVE ASSEMBLY	MATERIAL B-3X STEEL	WT./ LBS. 3.542	RELEASE 3-10-80
		FIN.	SHEET 1 OF 10

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
5	RECEIVE BAR STOCK 1 1/2 DIA. x 16'	RACKS												
10	CUT OFF BLANKS TO LENGTH NCT = 3.83 MIN/PC	POWER HACK SAW (1 MAN - 2 MACHINES)	2	10	2.40	11,200	10,000	200	1,000	500				
						11,200	10,000	200	1,000	500				
TOTALS						22,400				1,000				

REMARKS

PROCESS ENGR. J. CALHOUN	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR. OHANESIAN	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE 50,000 PER YR.	REQ'D. PER VEHICLE ONE	NEXT ASSY: SUPERSEDES:	OPER. NO.
<i>Stm</i> Mfg. Development Engrg. & Research					DAILY PLY. PLANNING VOLUME 208	REQMTS. 13 PC/HR. 16 HRS.		

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PLANT

D651133-18 DETAIL 5

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR ECR NO.		PART NAME		ISSUE DATES		PART NO.												
HELIOSTAT		SLOW SPEED SHAFT		9-12-80		B830234												
FOR MODELS		MATERIAL		WT./	RGH.	FIN.	RELEASE											
AZIMUTH DRIVE ASSEMBLY		B-3X STEEL		LBS.	3.542		3-10-80											
						SHEET 2 OF 10												
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP.	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST					
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD		INST. TRYS/DY				
20	CHUCK ON O.D. ROUGH TURN AND FACE ONE END  MCT = 1.00 MIN/PC	TRACER LATHE	1	38	1.26	175,000	160,000	2,500	12,500	15,000								
30	ROUGH TURN AND FACE OTHER END  MCT = 1.00 MIN/PC	TRACER LATHE	1	38	1.26	USE LATHE FROM OPERATION 20				7,000								
TOTALS						175,000				22,000								
REMARKS																		
Mfg. Development Engrg. & Research		PROCESS ENGR. J. CALHOUN	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE 50,000 PER YR.	REQ'D. PER VEHICLE ONE	NEXT ASSY:	OPER. NO.	INDUSTRY ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODM.	DAILY PLT. PLANNING VOLUME 208	REQMTS. 13 PC/HR. 16 HRS.	SUPERSEDES:

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PLANT

D651133-18 Detail 5

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR EER NO. HELIOSTAT	PART NAME SLOW SPEED SHAFT	ISSUE DATES 9-12-80	DEPARTMENT PART NO. B830234
FOR MODELS AZIMUTH DRIVE ASSEMBLY	MATERIAL B-3X STEEL	WT./ LBS. 3.542    RGH.    FIN.	RELEASE 3-10-80    SHEET 3 OF 10

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRVQ/2	
40	CHUCK ON O.D. GUN DRILL .420 DIA. HOLE 10.25 DEEP  MCT = 3.67 MIN/PC	SME GUN DRILLING MACHINE HIGH PRESSURE COOLANT SYSTEM FILTRATION SYSTEM MAGNETIC CHIP REMOVER 2 SPINDLES (1 MAN - 2 MACHINES)	2	10	2.40	80,500	70,000	1,500	9,000	6,000				
						80,500	70,000	1,500	9,000	6,000				
						62,000	50,000	2,000	10,000					
50	COUNTER BORE .79 DIA. BORE  MCT = .64 MIN/PC	SPEED LATHE	1	60	.80	9,200	8,000	200	1,000	500				
<b>TOTALS</b>						232,200				12,500				

REMARKS

	PROCESS ENGR. J. CALHOUN	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE 50,000 PER YR.	REQ'D. PER VEHICLE ONE	NEXT ASSY:	OPER. NO.
	INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLY. PLANNING VOLUME 208	REQMTS. 13 PC/HR. 16 HRS.	SUPERSEDES:	

*Stow* Mfg. Development  
Engrg. & Research

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PLANT \_\_\_\_\_ D651133-18 DETAIL 5 **PROCESS ESTIMATE SHEET** DEPARTMENT \_\_\_\_\_

PROGRAM OR ECM NO. HELIOSTAT	PART NAME SLOW SPEED SHAFT	ISSUE DATES 9-12-80	PART NO. B830234
FOR MODELS AZIMUTH DRIVE ASSEMBLY	MATERIAL B-3x STEEL	WT./ RGH. FIN. LBS. 3.542	RELEASE 3-10-80 SHEET 4 OF 10

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACH'S REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRVCAJ	
60	ROUGH PLUNG O.D. STEP (.600 DIA.) AND TURN THREAD DIAMETER  90 MIN/PC	SPEED LATHE	1	42	1.14	AVAILABLE	FROM OP	50		2,000				
70	<i>TURN</i> FINISH TURN O.D. PROFILE LOCATE ON CENTERS DOG ON SCREW DIAMETER  MCT - 90 MIN/PC	TRACER LATHE	1	42	1.14	AVAILABLE	FROM OP	20		5,000				
<b>TOTALS</b>										7,000				

REMARKS \_\_\_\_\_

Mfg. Development Engrg. & Research	PROCESS ENGR. J. CALHOUN	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE 50,000 PER YR.	REQ'D. PER VEHICLE ONE	NEXT ASBY:	OPER. NO.
	INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME 208	REQMTS. 13 PC/HR. 16 HRS.	SUPERSEDES:	

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PLANT

DG51133-18 D-7411 5

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR ECR NO. HELIOSTAT	PART NAME SLOW SPEED SHAFT	ISSUE DATES 9-12-80	PART NO. B830234
FOR MODELS AZIMUTH DRIVE ASSEMBLY	MATERIAL B-3X STEEL	WT./ LBS. 3.542 RGM. FIN.	RELEASE 3-10-80 SHEET 5 OF 10

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRVCT	
80	MILL 1/4" KEY WAY MCT = 1.25 MIN/PC	HORIZONTAL MILL	1	30	1.60	28,500	25,000	500	3,000	2,500				
90	MILL .125 KEY WAY MCT = 1.25 MIN/PC	HORIZONTAL MILL	1	30	1.60	USE OPERATION 80 MACHINE				1,500				
<b>TOTALS</b>						28,500				4,000				

REMARKS

	PROCESS ENGR. J. CALHOUN	PLT. LAYOUT	AUTOMATION	DESIGN	MATH. MDLG. ENGR.	DAILY SERVICE 50,000 /YR	REQ'D. PER VEHICLE ONE	NEXT ASSY:	OPER. NO.
Mfg. Development Engrg. & Research	INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME 208	REQM'TS. 13 PC/HR. 16 HRS.	SUPERSEDES.	

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PLANT \_\_\_\_\_ D651133-18 DETAIL 5

**PROCESS ESTIMATE SHEET**

DEPARTMENT \_\_\_\_\_

PROGRAM OR CER NO HELIOSTAT	PART NAME SLOW SPEED SHAFT	ISSUE DATES 9-12-80	DEPARTMENT
FOR MODELS AZIMUTH DRIVE ASSEMBLY	MATERIAL B-3x STEEL	WT./ LBS.    RGH.    FIN. 3.542	PART NO.    B830234 RELEASE    3-10-80    SHEET    6    OF    10

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUTS	
100	CHUCK ON DIA. A. BORE .8666 DIA. TO PREGRIND SIZE .95 MIN/PC	SPEED LATHE	1	40	1.20	9,200	8,000	200	1,000	1,000				
110	CHUCK ON O.D. - CUT THREAD .66-32 PER INCH 1.10 MIN/PC	SPEED LATHE W/THREADING DIE	1	34	1.41	USE OPERATION 100 MACHINE				500				
<b>TOTALS</b>						<b>9,200</b>				<b>1,500</b>				

REMARKS \_\_\_\_\_

PROCESS ENGR. J. CALHOUN	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE 50,000 PER YR. DAILY PLT. PLANNING VOLUME 208	REQ'D. PER VEHICLE ONE REQMTS. 13 PC/HR. 16 HRS.	NEXT ASSY: SUPERSEDES:	OPER. NO.
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*Slow* Mfg. Development  
Engng. & Research

PROCESS ESTIMATE SHEET

PROGRAM OR CER NO DELICONTAT	PART NAME SLOW SPEED SHAFT	ISSUE DATES 9-12-80	PART NO. B830234
FOR MODELS AZIMUTH DRIVE ASSEMBLY	MATERIAL B-3X STEEL	WT./LBS. 3.542	RELEASE 3-10-80 SHEET 7 OF 10

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR D.T. NUMBER	MACH'S RECD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. FRYCJT	
120	HEAT TREATMENT	HEAT TREAT FURNACE QUENCH DRAW FURNACE	1		-	AVAILABLE	IN HEAT	TREAT						
125	INSPECT	HARDNESS CHECKER BENCH ZYGLO CRACK INSP.	1		IND. LAB	AVAILABLE	IN HEAT	TREAT		5,000				
<b>TOTALS</b>										5,000				

REMARKS

		PROCESS ENGR. J. CALHOUN	PLT. LAYOUT LAB.	AUTOMATION	DESIGN PLT. ENGR.	MATH. MDLG. ENGR. PRDGN.	DAILY SERVICE 50,000 PER YR. DAILY PLT. PLANNING VOLUME 208	REQ'D. PER VEHICLE ONE REQMTS. 13 PC/HR. 16 HRS.	NEXT ASSY: SUPERSEDES:	OPER. NO.
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*Stow* Mfg. Development  
Engrg. & Research

PLANT

D651133-18 Detail 5

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR ECM NO.		PART NAME				ISSUE DATES			PART NO.						
HELIOSTAT FOR MODELS AZIMUTH DRIVE ASSEMBLY		SLOW SPEED SHAFT				9-12-80			B830234						
		MATERIAL		WT./	RGH.	FIN.	RELEASE		SHEET		OF				
		B-3X STEEL		LBS.	3.542		3-10-80		8		10				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTAL-LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
130	LOCATE FROM CENTERS, DOG AT THRFAD & KEY FINISH GRIND DIAMETER 'A' AND TWO 1.180 DIAMETERS  NCT = .95 MIN/PC	CYLINDRICAL MULTIWHEEL O.D. GRINDER PLUNGE	1	40	1.20	79,000	72,000	1,000	6,000	6,000					
140	CHUCK ON O.D. - BRONCE JAWS - FINISH GRIND I.D. COUNTERBORE TO SIZE  NCT = 1.50 MIN/PC	I.D. GRINDER	1	25	1.92	82,000	75,000	1,000	6,000	5,000					
TOTALS						161,000				11,000					
REMARKS															
PROCESS ENGR.		PLY. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO.					
INDUSTR. ENGR.		LAB.	QUAL. CONTR.	PLT. ENGR.	PRODM.	50,000 PER YR.	ONE	SUPERSEDES:							
Mfg. Development Engrg. & Research						DAILY PLT. PLANNING VOLUME	REQMTS.								
						208	13PC/NR. 16 HRS.								

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**PROCESS ESTIMATE SHEET**

PROGRAM OR ECR NO. HELIOSTAT	PART NAME SLOW SPEED SHAFT	ISSUE DATES 9-12-80	DEPARTMENT PART NO. B 830234
FOR MODELS AZIMUTH DRIVE ASSEMBLY	MATERIAL B-3X STEEL	WT./ LBS. 3.542    RGH.    FIN.	RELEASE 3-10-80    SHEET 9 OF 10

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD		INST. TRVOLT
150	POLISH TWO OUTSIDE DIAMETERS TO 20 MICRO-INCHES  NCT = 1.10 MIN/PC	PAPER POLISHER	1	34	1.41	62,000	56,000	1,000	5,000	3,000				
155	FINAL INSPECTION	GAGES BENCH LIGHTING PROFILOMETER AIR GAGES				PE -				7,000				
	PERSONAL RELIEF				1.39									
<b>TOTALS</b>					22.13	62,000				10,000				

REMARKS \_\_\_\_\_

	PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATH. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.
	INDUSTR. ENGR.	J. CALHOUN	QUAL. CONTR.	PLT. ENGR.	PRODN.	50,000 PER YR. DAILY PLY. PLANNING VOLUME 208	ONE REQTS. 13 PC/HR. 16 HRS.	SUPERSEDES:	

*Stow* Mfg. Development Engrg. & Research

PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO.		PART NAME			ISSUE DATES			DEPARTMENT							
HELIOSTAT		SLOW SPEED SHAFT			9-17-80			PART NO. 830234C							
FOR MODELS		MATERIAL			WT./	RGH.	FIN.	RELEASE		SHEET 10 OF 10					
AZINUTH DRIVE ASSEMBLY		PLANT ENGINEERING REQUIREMENTS			LBS.										
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHTS. REQS.	NET HOURLY CAP.	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRVCT		
1.	CHIP - COOLANT AND CLARIFICATION SYSTEMS					124,000	80,000	4,000	40,000						
2.	COOLANT REFRIGERATION SYSTEM														
3.	EXHAUST - FUME - DUST AND VENTILATION														
4.	CO <sub>2</sub> FIRE PROTECTION SYSTEM														
5.	MONORAIL CONVEYORS	400' @ 200				80,000	40,000		40,000						
6.	MONORAIL CARRIERS (TOOLING)	4'c = @ \$100 x 100								10,000					
7.	ROLLER CONVEYOR														
8.	POWERED CONVEYORS														
9.	PLATFORMS - STILES														
10.	SERVICE RAILS AND HOISTS														
11.	TOOL CABINETS - RACKS AND STANDS					2,200	1,000	200	1,000						
12.	TOOL CONTROL BOARDS														
13.	WORK - CAGING AND INSPECTION TABLES					4,000	2,000		2,000						
14.	PARTS BASKETS (EXPENSE) 1.5" x 9" = 2 x 9 = 18 + 208 x 5 day = 58 (60 x 50)														3,000
15.	PRODUCTION AIDS - ASSEMBLY AIDS					4,000	2,000		2,000						
16.	SECONDARY LIGHTING														
17.	PROGRAMMABLE CONTROLLERS														
18.	AUTOMATION - PART HANDLING SYSTEM														
19.	ENGINEERING SERVICES DESIGN (EXPENSE)														3,000
20.	BUILDING SERVICES - UTILITIES														
21.	POWER AND FREE CONVEYOR SYSTEM														
22.	POWER AND FREE CONVEYOR CARRIERS (TOOLING)														
23.	MACHINE FOUNDATIONS AND DECKS														
24.	PLANT REARRANGEMENT (EXPENSE)														
25.	MATERIALS HANDLING - RACKS - CONTAINERS - DUNNAGE					4,200	3,000	200	1,000						
BUILDING CONSTRUCTION		5600 SQ. FT.				218,400				10,000					6,000
TOTALS															
REMARKS		TOTALS: FAC. - 908,700 TOOLC. - 84,000 } \$998,700 EXP. - 6,000													
		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MOLDG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
Mfg. Development Engrg. & Research		INDUSTRY ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES.						

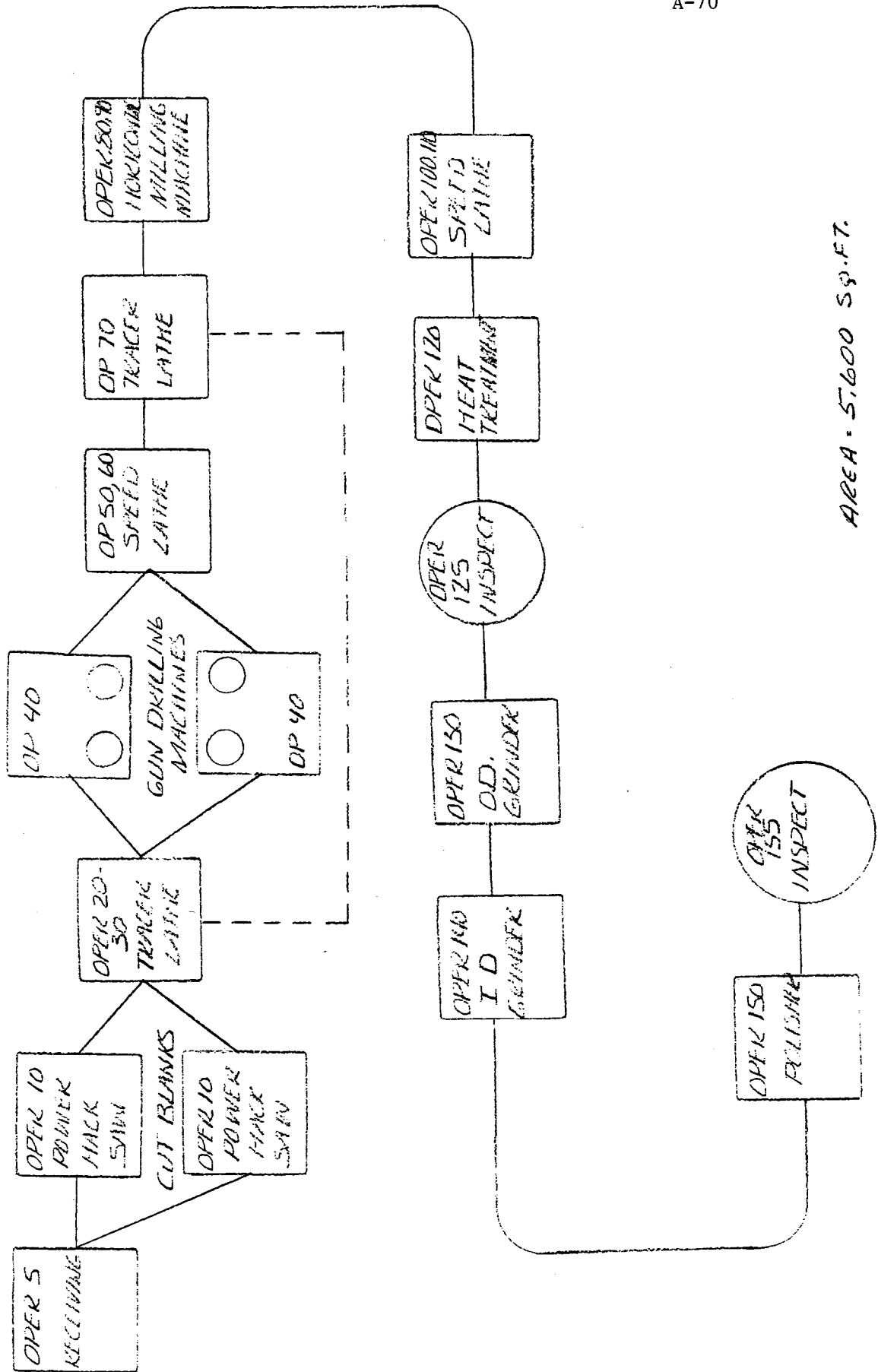
6

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6

PROCESS SEQUENCE FOR  
SLOW SPEED SHAFT  
D651155-18 DETAIL 5  
WINDMILL NO. B830Z34

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AREA - 57,600 SQ. FT.

PLANT \_\_\_\_\_ D651133-18-DETAIL 7

**PROCESS ESTIMATE SHEET**

DEPARTMENT: \_\_\_\_\_

PROGRAM OR CTR NO. HELIOSTAT FOR MODELS AZIMUTH DRIVE ASSEMBLY		PART NAME S.S. SPACER SHORT			ISSUE DATES 9-11-80		PART NO. 835235								
MATERIAL STEEL		WT./ LBS.		RGH. .14		FIN.		RELEASE 3-11-80		SHEET 1 OF 3					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. BY CAT		
5	RECEIVE TUBING STOCK	STOCK RACK HOIST AVAILABLE FROM DETAIL 8			IND. LAB										
10	LOAD BARS INTO ABRASIVE CUTOFF MACHINE - CUT OFF SPACER BLANKS TO SIZE	AUTOMATIC ABRASIVE CUTOFF MACHINE WITH MAGAZINE BAR FEEDER	1	96	.50	99,000	9,000	2,000	7,000	7,000					
	MCT .40 MIN/PC					13,000	10,000	1,000	2,000						
<b>TOTALS</b>										7,000					
<b>REMARKS</b>															
PROCESS ENGR. J. CALHOUN		PLT. LAYOUT		AUTOMATION		DESIGN		MATH. MDLG. ENGR.		DAILY SERVICE 50,000 PER YR.		REQ'D. PER VEHICLE ONE		NEXT ASSY:	
INDUSTYR. ENGR. S. LEWIS		LAB.		QUAL. CONTR.		PLT. ENGR. OHANESIAN		PRDGN.		DAILY PLT. PLANNING VOLUME 208		REQMTS. 13 PC/HR. 16 HRS.		SUPERSEDES:	

Mfg. Development  
Engrg. & Research

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PROCESS ESTIMATE SHEET

PROGRAM OR CER NO. HELIOSTAT	PART NAME S. S. SPACER SHORT	ISSUE DATES 9-10-80	PART NO. 835235
FOR MODELS AZIMUTH DRIVE ASSEMBLY	MATERIAL STEEL	WT./ LBS. .14	RELEASE 3-11-80 SHEET 2 OF 3

8

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRAVEL	
20	LOAD PART ONTO ROTARY MAGNETIC CHUCK - GRIND ONE FACE, TURN OVER GRIND SECOND FACE  NCT 4.2 MIN/20 PC .21 MIN/PC	BLANCHARD GRINDER	1	182	.25	AVAILABLE FROM DETAIL # 3 3.9 (D651140-18)				1,000				
30	DEMAGNETIZE	DEMAG. COIL	1		INC. IN CYCLE	AVAILABLE FROM DETAIL 3 .9 (D651140-18)				-				
40	CHUCK ON O.D. - BORE ID TO SIZE .68 MIN/PC	SINGLE SPINDLE BORING MACHINE	1	56	.86	AVAILABLE FROM DETAIL 9 (D651140-18)				5,000				
<b>TOTALS</b>										6,000				

REMARKS

	PROCESS ENGR. J. CALHOUN	PLT. LAYOUT	AUTOMATION	DESIGN	MATT. MDLG. ENGR.	DAILY SERVICE 50,000 PER YR.	REQ'D. PER VEHICLE ONE	NEXT ASSY:	OPER. NO.
Mfg. Development Engrg. & Research	INDUSYR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME 208	REQMTS. 13 PC/HR. 16 HRS.	SUPERSEDES.	

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PROCESS ESTIMATE SHEET

PROGRAM OR CEN NO.		PART NAME			ISSUE DATES		DEPARTMENT							
HELIOSTAT		S.S. SPACER SHORT			9-10-80		PART NO. 835235							
FOR MODELS		MATERIAL			WT./	RGM.	FIN.	RELEASE		SHEET	OF			
AZIMUTH DRIVE ASSEMBLY		STEEL			LBS.	.14		3-11-80		3	3			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACH'Y REVD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
50	WASH	INDUSTRIAL PARTS WASHER	1		INC. IN CYCLE	AVAILABLE FROM DET (D651140-18)	11.9							
60	FINAL INSPECTION	GAGES RACKS LIGHTS BENCH			IND. LAB					3,000				
	PERSONAL RELIEF				.11									
TOTALS					1.72					3,000				
REMARKS TOTALS: FAC. - 0 TOOLC. - 8,000 EXP. - 0												8,000		
Mfg. Development Engrg. & Research		PROCESS ENGR. J. CALHOUN	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE 50,000 PER YR. DAILY PLT. PLANNING VOLUME 208	REQ'D. PER VEHICLE ONE REQMTS. 13 PC/HR.	NEXT ASSY: SUPERSEDES:	OPER. NO.				

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PROCESS ESTIMATE SHEET

PLANT

DEPARTMENT

PROGRAM OR CTR NO. HELIOSTAT	PART NAME S.S. SPACER LONG	ISSUE DATES 9-11-80	PART NO. 835236
FOR MOOFS AZIMUTH DRIVE ASSEMBLY	MATERIAL STEEL	WT./ LBS. RGH. FIN. .14	RELEASE 3-11-80 SHEET 1 OF 3

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. RECD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
2	RECEIVE TUBING STOCK													
10	LOAD BAR INTO ABRASIVE CUTOFF MACHINE - CUT OFF BLANK TO SIZE  .40 MIN/PC	ABRASIVE CUTOFF MACHINE	1	96	50	AVAILABLE FROM DETAIL 7 D651140-8 DETAIL 7				7000				
<b>TOTALS</b>										7000				

REMARKS

Mfg. Development Engrg. & Research	PROCESS ENGR. J. CALHOUN	PLT. LAYOUT	AUTOMATION	DESIGN	MATH. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.
	INDUSTRIAL ENGR. S. LEVIS	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESIAN	PRODN.	DAILY PLT. PLANNING VOLUME 208	ONE 13 PC/HR. 16 HRS.	SUPERSEDES:	

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**PROCESS ESTIMATE SHEET**

PLANT _____		<b>PROCESS ESTIMATE SHEET</b>					DEPARTMENT _____							
PROGRAM OR ECR NO. HELIOSTAT		PART NAME S.S. SPACER LONG			ISSUE DATES 9-11-80		PART NO. 835236							
FOR MODELS AZIMUTH DRIVE ASSEMBLY		MATERIAL STEEL 1010		WT./ LBS.	RGM. .14	FIN.	RELEASE 8-11-80	SHEET 2	OF 3					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYS/23	
20	LOAD PARTS ONTO ROTARY MAGNETIC CHUCK - GRIND ONE FACE, TURN OVER GRIND SECOND FACE .21 MIN/PC	BLANCHARD GRINDER	1	182	.26	AVAILABLE	FROM	DETAIL 3		2000				
30	DEMAGNETIZE	DEMAG. COIL	1		INC. IN CYCLE	AVAILABLE	FROM	DETAIL 3						
40	BORE ID TO SIZE .71 MIN/PC	SINGLE SPINDLE BORE	1	54	89	AVAILABLE	FROM	DETAIL 9		5000				
<b>TOTALS</b>										7000				
REMARKS														
PROCESS ENGR. J. CALHOUN		PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME 208	REQ'D. PER VEHICLE ONE 13PC/NR.	NEXT ASSY: SUPERSEDES:	OPER. NO.					

*Stow* Mfg. Development  
Engrg. & Research



PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO. HELIOSTAT		PART NAME S.S. SPACER LONG			ISSUE DATES 9-11-80		DEPARTMENT							
FOR MODELS AZIMUTH DRIVE ASSEMBLY		MATERIAL STEEL 1010			WT./ LBS.	RGH. .14	FIN.	PART NO. 835236		RELEASE 3-11-80	SHEET 3 OF 3			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTAL- LATION	TOTAL	DESIGN	BUILD	INST. PRYCAT	
50	WASH	INDUSTRIAL PARTS WASHER	1		INC IN CYCLE	AVAILABLE								
60	FINAL INSPECTION	GAGES			IND LAB					3000				
	PERSONAL RELIEF				.11									
TOTALS					1.76					3000				
REMARKS TOTAL: FAC. - 0 TOOLG. - 10,000 = 10,000 EXP. - 0														
PROCESS ENGR. J. CALHOUN		PLT. LAYOUT	AUTOMATION	DESIGN	NATL. MDLG. ENGR.	DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:		OPER. NO.		
INDUSYR. ENGR.		LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME 208		REQMYS. 13 PC/HR. 16 HRS.		SUPERSEDES:				
<i>Stard</i> Mfg. Development Engrg. & Research														

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PROGRAM OR ECR NO. <b>HELIOSTAT</b>	PART NAME <b>H.S. HOUSING BUSHING</b>	ISSUE DATES <b>9-11-80</b>	DEPARTMENT <b>A-835234-A</b>
FOR MODELS <b>AZIMUTH DRIVE ASSEMBLY</b>	MATERIAL <b>STEEL TUBING</b>	WT./ LBS. <b>.70</b>	RELEASE <b>2-29-80</b> SHEET <b>1</b> OF <b>4</b>

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRAVEL	
5	RECEIVE STEEL TUBING													
10	LOAD BAR ONTO ABRASIVE CUTOFF MACHINE - CUT BLANKS TO LENGTH  40 MIN PER PC	ABRASIVE CUTOFF MACHINE	1	96	.50	AVAILABLE FROM DET - 7 (D651140-18)				2,000				
20	GRIND O.D. TO SIZE  NICT. 20 MIN/PC	CENTERLESS GRINDER AUTOMATION	1	192	.25	82,500	75,000	1,500	6,000	5,000				
		SYNTRON FEEDER	1			8,200	7,000	200	1,000	1,000				
<b>TOTALS</b>						<b>90,700</b>				<b>8,000</b>				

REMARKS

	PROCESS ENGR. <b>J. CALHOUN</b>	PLT. LAYOUT	AUTOMATION	DESIGN	MATH. MDLG. ENGR.	DAILY SERVICE <b>50,000 PER YR.</b>	REQ'D. PER VEHICLE <b>ONE</b>	NEXT ASSY:	OPER. NO.
	INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR. <b>OHANESIAN</b>	PRODN.	DAILY PLT. PLANNING VOLUME <b>208</b>	REQMTS. <b>13 PC/HR. 16 HRS.</b>	SUPERSEDES:	

*Stand* Mfg. Development Engrg. & Research

PLANT

D651133-18 DETAIL 9

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR CTR NO. HELIOSTAT	PART NAME H.S. HOUSING BUSHING	ISSUE DATE 9-11-80	PART NO. A-835234-A
FOR MODELS AZIMUTH DRIVE ASSEMBLY	MATERIAL STEEL TUBING	WT./LBS.	RELEASE 2-29-80 SHEET 2 OF 4

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
30	LOAD PARTS ONTO ROTARY MAGNETIC CHUCK. GRIND ONE FACE. TURN OVER GRIND SECOND FACE.  .21 MIN/PC.	BLANCHARD GRINDER	1	182	.26	AVAILABLE FROM DETAIL 3 (D651140-18)					2,000				
40	DEMAGNETIZE	DEMAG. COIL	1		INC. IN MACH CYC.	AVAILABLE FROM DETAIL 3 (D-65140-18)									
50	BORE ID TO SIZE & CONCENTRIC TO O.D.	SINGLE SPINDLE BORE	1	47	1.02	AVAILABLE FROM DETAIL 9 (D651140-18)					5,000				
<b>TOTALS</b>											7,000				

REMARKS

		PROCESS ENGR. J. CALHOUN	PLT. LAYOUT	AUTOMATION	DESIGN	MATH. MDLG. ENGR.	DAILY SERVICE 50,000 PER YR.	REQ'D. PER VEHICLE ONE	NEXT ASSY:	OPER. NO.
Mfg. Development Engrg. & Research		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME 208	REQMTS. 13 PC/HR. 16 HRS.	SUPERSEDES:	

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PLANT

D651133-18 DETAIL 9

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR ECA NO. HELIOSTAT		PART NAME H.S. HOUSING BUSHING				ISSUE DATES 9-11-80			PART NO. A-835234-A					
FOR MODELS AZIMUTH DRIVE ASSEMBLY		MATERIAL STEEL TUBING		WT./ LBS.	RGH. .70	FIN.	RELEASE 2-29-80		SHEET 3 OF 4					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACHS. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTAL-LATION	TOTAL	DESIGN	BUILD	INST. TRYS/JT	
60	WASH	INDUSTRIAL WASHER			INC. IN MACH CYC	AVATLABLE								
70	FINAL INSPECTION	GAGES			IND. LAB					3,000				
	PERSONAL RELIEF				.14									
TOTALS						2.17				3,000				
REMARKS														
PROCESS ENGR. J. CALHOUN		PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE 50,000 PER YR.	REQ'D. PER VEHICLE ONE	NEXT ASSY:		OPER. NO.				
INDUSTR. ENGR.		LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME 208	REOMTS. 13 PC/HR. 16 HRS.	SUPERSEDES:						

Mfg. Development  
Engg. & Research

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PLANT

D651133-18-DETAIL 9

PROCESS ESTIMATE SHEET

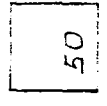
DEPARTMENT:

PROGRAM OR ECR NO. HELIOSTAT FOR MODELS AZIMUTH DRIVE ASSEMBLY		PART NAME H. S. HOUSING BUSHING MATERIAL PLANT ENGINEERING REQUIREMENTS			ISSUE DATES 9-12-80		DEPARTMENT: PART NO. A-835234-A RELEASE SHEET 4 OF 4								
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACH'Y REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRAVEL		
1.	CHIP COOLANT AND CLARIFICATION SYSTEMS					15,200	10,000	200	5,000						
2.	COOLANT REFRIGERATION SYSTEM														
3.	EXHAUST - FUME - DUST AND VENTILATION														
4.	CO <sub>2</sub> FIRE PROTECTION SYSTEM														
5.	MONORAIL CONVEYORS					20,000	10,000		10,000						
6.	MONORAIL CARRIERS (TOOLING)									5,000					
7.	ROLLER CONVEYOR														
8.	POWERED CONVEYORS														
9.	PLATFORMS - STILES														
10.	SERVICE RAILS AND HOISTS														
11.	TOOL CABINETS - RACKS AND STANDS					1,000	500		500						
12.	TOOL CONTROL BOARDS														
13.	WORK - GAGING AND INSPECTION TABLES					1,000	500		500						
14.	PARTS BASKETS (EXPENSE)														4,000
15.	PRODUCTION AIDS - ASSEMBLY AIDS														
16.	SECONDARY LIGHTING														
17.	PROGRAMMABLE CONTROLLERS														
18.	AUTOMATION - PART HANDLING SYSTEM														
19.	ENGINEERING SERVICES DESIGN (EXPENSE)														1,000
20.	BUILDING SERVICES - UTILITIES														
21.	POWER AND FREE CONVEYOR SYSTEM														
22.	POWER AND FREE CONVEYOR CARRIERS (TOOLING)														
23.	MACHINE FOUNDATIONS AND DECKS														
24.	PLANT REARRANGEMENT (EXPENSE)														
25.	MATERIALS HANDLING - RACKS - CONTAINERS - DUNNAGE					2,500	2,000		500						
BUILDING CONSTRUCTION		400 SQ. FT.													
TOTALS						39,700				5,000					5,000
REMARKS TOTAL: FAC. - 130,400 TOOLG - 23,000 } = 158,400 EXP. - 5,000															
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO.				
		INDUSTRIAL ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQ'TS. PC/HR. HRS.	SUPERSEDES.						

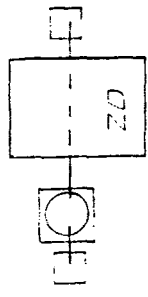
A-80

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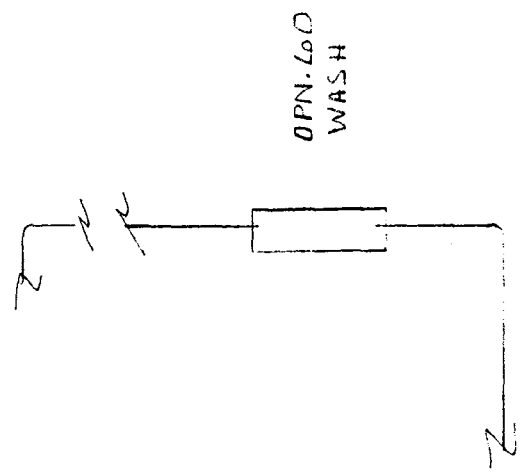
OPN. 50  
BORE  
AVAIL.



OPN. 30-40  
BLANCHARD  
AVAIL.



OPN. 20  
CENTER/END GRIND  
WITH AUTO-FIELD



OPN. 70  
INSPECT

AREA- 400 SQ. FT.  
H.S. HOUSING BUSHING  
A-835234-A

PROCESS ESTIMATE SHEET

DEPARTMENT: \_\_\_\_\_

(17)

PROGRAM OR P/R NO. HELIOSTAT		PART NAME BASE HOUSING			ISSUE DATES 4-7-80		PART NO. D-926610							
FOR MODELS AZIMUTH DRIVE ASSEMBLY		MATERIAL NODULAR IRON			WT./ LBS. 105	RGH. FIN.	RELEASE		SHEET 1 OF 6					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. BY Q/ST	
10	REC. INSPECTION CHECK FOR SUFFICIENT MACHINING STOCK, SOUNDNESS OF CASTING, EXCESSIVE METAL FLASH, AND QUALITY OF CASTING CHECK DIMENSIONALLY EVERY THOUSANDTH CASTING, DIMENSIONALLY 100% TO CASTING B/P.	TEMPLATE GAGES	N		P.E.	1,000			1,000	\$ 8,000				
20	TURN BOTTOM AND TOP MOUNTING SURFACE .005 FLATNESS.	VERTICAL CHUCKING MACHINE TEMPLA-TURN 25 TCA-BULLARD TWIN SPINDLE	I-N	20	2.40		240,000			\$ 30,000				
						262,000		4,000	18,000					
	MANUAL LOAD POS. #1 UNLOAD INTO POS. #2	BALANCE HOIST LOADER	N			P.E.								
		GAGES	N			1,000			1,000	\$ 6,000				
		POWERED CONVEYOR SYSTEM THROUGH OUTALL OPERATIONS	N											
TOTALS						264,000	240,000			44,000				
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR. P. BOES	PLT. LAYOUT LAB.	AUTONATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PRODM.	DAILY SERVICE DAILY PLT. PLANNING VOLUME	REQ'D. PER VEHICLE 1	REQMTS. 16 PC/HR. 16 HRS.	MENT ASSV: SUPERSEDES:	OPER. NO. 10 20			

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### PROCESS ESTIMATE SHEET

PROGRAM OR CER NO.		PART NAME				ISSUE DATES		DEPARTMENT					
FOR MODELS		MATERIAL				WT. /	RGH.	FIN.	PART NO.		SHEET		
AZIMUTH DRIVE ASSEMBLY						LBS.			D-926610		2	6	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACHS. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	
	CONTINUED												
20	ROUGH AND FINISH TURN STATIONARY RING GEAR-MOUNTING SURF.-PILOT DIA. AND END EDGE SURF.												
	ROUGH TURN AND FINISH TURN PLANET CARRIER SURF.	GAGES	N			1,000			1,000	10,000			
	HANDUAL UNLOAD POS. #2 FINISHED PART												
	UNLOAD POS. #1 INTO POS. #2												
TOTALS						1,000				10,000			
REMARKS													
PROCESS ENGR. P. BOES		PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MOLD. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE		NEXT ASSY:		OPER. NO.		
INDUSTR. ENGR.		LAB.	QUAL. CONTR.	PLT. ENGR.	PROOH.	DAILY PLT. PLANNING VOLUME	REQMTS. 16 PC/MR. 16 HRS.		SUPERSEDES:		30		

*Stow* Mfg. Development  
Engrg. & Research



PROCESS ESTIMATE SHEET

PLANT		PROCESS ESTIMATE SHEET										DEPARTMENT:		
PROGRAM OR CER NO.		PART NAME				ISSUE DATES				PART NO.				
FOR MODELS		BASE HOUSING								D-926610				
AZINUTH DRIVE ASSEMBLY		MATERIAL				WT. / LGH. FIN.				RELEASE				
						LBS.				SHEET 3 OF 6				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REED.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. BYG/UT	
30	DRILL BOTTOM SURF. (9) BOLT HOLES	NATCO MULTI-9 SPINDLE DRILL PRESS	T-N	50	0.96	88,000	80,000	2,000	6,000	15,000				
	MANUAL LOAD AND UNLOAD	BALANCE HOIST	N											
40	DRILL TOP SURFACE (18) BOLT HOLES	NATCO MULTI-18 SPINDLE	I-N	50	0.96	110,000	100,000	2,000	8,000	25,000				
	MANUAL LOAD AND UNLOAD	BALANCE HOIST												
TOTALS						198,000				40,000				
REMARKS														
Mfg. Development		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
Engr. & Research		INDUSTY. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODM.	DAILY PLT. PLANNING VOLUME	REQMYS. PC/HR. HRS.	SUPERSEDES:	40		50		

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PROCESS ESTIMATE SHEET

PLANT _____		PROGRAM OR EER NO.						PART NAME BASE HOUSING				ISSUE DATES		DEPARTMENT					
FOR MODELS AZIMUTH DRIVE ASSEMBLY		MATERIAL						WT. / LBS.				RGH. FIN.		PART NO. D-926610		RELEASE		SHEET 4 OF 6	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST					
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INIT. TAYOUT						
50	BOTTOM SURFACE SLOT MILL (9) BOLT BOSS BACK FACE SURFACES	SPEC. INDEX MILL (9) POSITION INDEX INCLUDING (1) HORIZ. SLIDE UNIT MACH.	I-H	40	1.20	165,000	150,000	3,000	12,000	30,000									
	MANUAL LOAD AND UNLOAD	BALANCE HOIST																	
TOTALS						165,000				30,000									
REMARKS																			
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLY. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.									
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLY. ENGR.	PRODN.	DAILY PLY. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:										

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**PROCESS ESTIMATE SHEET**

(11)

PLANT _____		PROGRAM OR EER NO.						PART NAME				ISSUE DATES				DEPARTMENT			
		BASE HOUSING										PART NO.							
FOR MODELS		AZIMUTH DRIVE ASSEMBLY						MATERIAL				WT./ LBS.				RGH. FIN.			
												RELEASE				SHEET 5 OF 6			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'Y REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST					
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRVCT						
	(OFF-LINE OPERATION)																		
55R	REPAIR OPERATION HOLES AND DE-BURR 1-1/2% OF PRODUCTION	4' RADIAL DRILL PRESS HAND TOOLS	I-N N			88,000	80,000	2,000	6,000	10,000	500								
60	WASH-RINSE AND DRY MANUAL LOAD AND UNLOAD	3 STAGE WASHER ALSO USED FOR ALL MAJOR CASTINGS	I-N	300	0.16	P.E.	AVAILABLE												
70	INSPECTION	BALANCE HOIST GAGES				2,000	1,000		1,000	6,000									
80	PLACE IN CONTAINER AND SHIP TO ASSEMBLY AREA	BALANCE HOIST			0.25														
	PERSONAL RELIEF				0.40														
<b>TOTALS</b>					6.33	90,000				16,500									
<b>REMARKS</b>																			
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.									
		INDUSTY. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. MRS.	SUPERSEDES:										

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PROCESS ESTIMATE SHEET

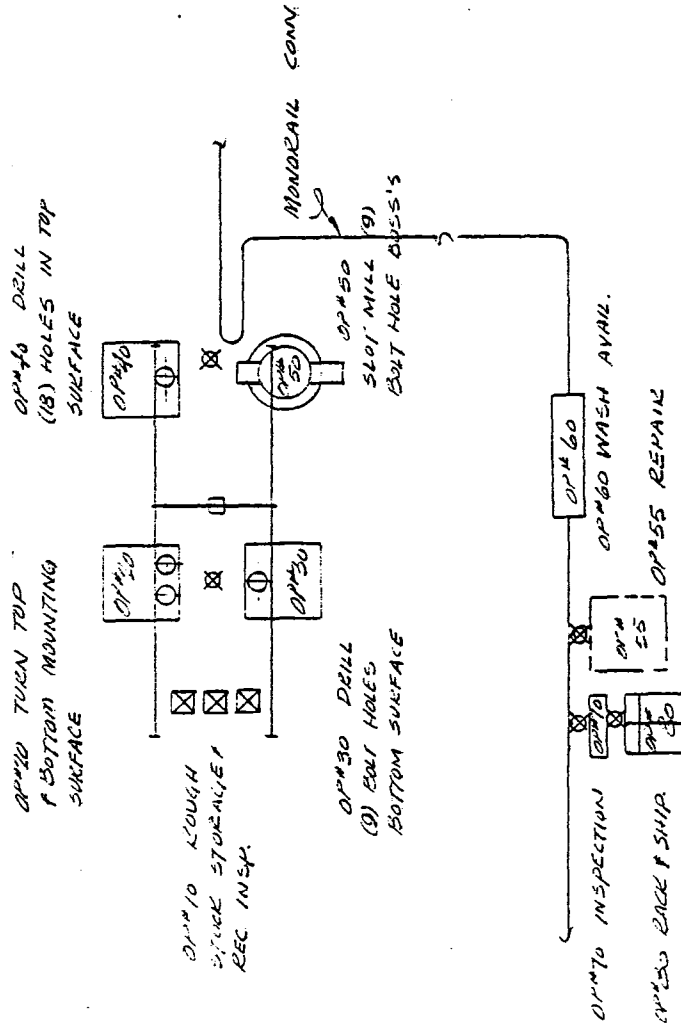
PROGRAM OR ECN NO. HELIOSTAT	PART NAME BASE HOUSING	ISSUE DATES	DEPARTMENT
FOR MODELS AZIMUTH DRIVE ASSEMBLY	MATERIAL PLANT ENGINEERING REQUIREMENTS	WT./ LBS.	RGH.
		FIN.	PART NO. D-926610
			RELEASE
			SKZT 6
			CS 6

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. RECD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. COST
1	CHIP - COOLANT AND CLARIFICATION SYSTEMS					83,000	60,000	3,000	20,000				
2	COOLANT REFRIGERATION SYSTEM												
3	EXHAUST - FUME - DUST AND VENTILATION												
4	CO2 FIRE PROTECTION SYSTEM												
5	MONORAIL CONVEYORS					40,000	20,000		20,000				
6	MONORAIL CARRIERS (TOOLING)									10,000			
7	ROLLER CONVEYOR					12,000	8,000	1,000	3,000				
8	POWERED CONVEYORS												
9	PLATFORMS - STILES												
10	SERVICE RAILS AND HOISTS					12,000	6,000		6,000				
11	TOOL CABINETS - RACKS AND STANDS					3,000	2,000		1,000				
12	TOOL CONTROL BOARDS												
13	WORK - GAGING AND INSPECTION TABLES					8,000	5,000		3,000				
14	PARTS BASKETS (EXPENSE)												
15	PRODUCTION AIDS - ASSEMBLY AIDS					5,000	3,000		2,000				
16	SECONDARY LIGHTING					1,000	500		500				
17	PROGRAMMABLE CONTROLLERS												
18	AUTOMATION - PART HANDLING SYSTEM												
19	ENGINEERING SERVICES DESIGN - (EXPENSE)												10,000
20	BUILDING SERVICES - UTILITIES												
21	POWER AND FREE CONVEYOR SYSTEM												
22	POWER AND FREE CONVEYOR CARRIERS (TOOLING)												
23	MACHINE FOUNDATIONS AND DECKS												
24	PLANT REARRANGEMENT (EXPENSE)												
25	MATERIALS HANDLING - RACKS - CONTAINERS - DAMAGE												
	BUILDING CONSTRUCTION												
		3600 SQ.FT.											
TOTALS						164,000				10,000			10,000

REMARKS TOTALS: F. 882,000  
 T. 150,500 \$1,042,500  
 E. 10,000

PROCESS ENG.	PLT. LAYOUT	AUTOMATION	DESIGN	MAT. H.D.L. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	COALING
					DAILY PLT. PLANNING	INVENTORY	SUPPLEMENT	

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SAFT REQ'D 3600

BASE HOUSING PT # 926610 MODULAR IRON
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GROSS 20 PCS./HR.

PROCESS ESTIMATE SHEET

DEPARTMENT: \_\_\_\_\_

(12)

PROGRAM OR CTR NO. HELIOSTAT		PART NAME COVER-HOUSING			ISSUE DATES REV. DRWN 3-26-80			PART NO. D-926220						
FOR MODELS 50,000 ANNUALLY - ASSEMBLY		MATERIAL MODULAR IRON			WT./ LBS. 92#	RGH.	FIN.	RELEASE	SHEET 1 OF 6					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTAL- LATION	TOTAL	DESIGN	BUILD		INST. TRUCK
10	REC. INSPECTION:	TEMPLATE GAGES	N			1,000			1,000	6,000				
	CHECK FOR SUFFICIENT MACHINE STOCK, ROUNDNES OF CASTING, EXCESSIVE METAL FLASH, AND QUALITY OF CASTING													
	CHECK DIMENSIONALLY EVERY THOUSANDTH CASTING, DIMENSIONALLY 100% TO CASTING B/P													
10	REC. INSP.	BALANCE HOISE & RAIL				PE								
	MATERIAL LOAD AND UNLOAD	POWER ROLLER CONVEYOR	N			PE								
	ROLLER CONVEYOR	SYSTEM THROUGH OUT ALL OPERATIONS												
TOTALS						1,000			1,000	6,000				
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR. P. BOES	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQ'TS. 16 PCS/HR. 16 HRS.	SUPERSEDES:				10	

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**PROCESS ESTIMATE SHEET**

(12)

PLANT		PROGRAM OR CR NO.						PART NAME COVER HOUSING				ISSUE DATES		DEPARTMENT	
FOR MODELS AZIMUTH DRIVE ASSEMBLY		MATERIAL						WT./ LBS.				PART NO. D-926220		RELEASE	
												SHEET 2 OF 6			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S RECD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. BYG. JT		
20 A	ROUGH AND FINISH TURN GEAR BOX MOUNTING SURFACE	N.B. VERT. BORTNG AND TURNING MACHINE MOD #66 SINGLE SPINDLE	1-N	15	3.20		185,000			20,000					
	ROUGH AND FINISH TURN GIMBAL MOUNTING SURFACE ALSO USED FOR MFG. LOCATING SURFACE					203,000		3,000	15,000						
	FIRST CHECKING	GAGES	N			2,000			2,000	9,000					
	MANUAL LOAD AND UNLOAD	BALANCE HOISE LOADER	N		INC. IN MACH CYCLE										
<b>TOTALS</b>						205,000	185,000	3,000	17,000	29,000					
REMARKS															
Mfg. Development Engr. & Research		PROCESS ENGR. P. BOES	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MOLD. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NET ASSY.	SUPERSEDES.		OPER. NO. 20A			
		INDUSTY. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/NR.	NRS.						

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PROCESS ESTIMATE SHEET

PROGRAM OR EEA NO.		PART NAME				ISSUE DATES		DEPARTMENT						
AZIMUTH DRIVE ASSEMBLY		COVER HOUSING						D-926220						
FOR MODELS		MATERIAL			WT./	RGH.	FIN.	RELEASE		SHEET				
					LBS.					3 OF 6				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD		INST. TRVCT
20	FIRST CHUCKING													
	ROUGH AND FINISH TURN	BULLARD 25" DIA. MODEL TCB	T-N	15	3.20		245,000			25,000				
		TWIN SPINDLE FIXED TOOLING				269,000		4,000	200,000					
19	CENTER PILOT 2.252 DIA. VERT. FEED	VERTICAL CHUCKING MACHINE												
14	ROUGH TURN ONLY													
	21.00 O.D. AND "O" RING GROOVE FORM VERT. FEED													
30	SECOND CHUCKING													
	ROUGH AND FINISH TURN	GAGES	N							16,000				
	UPPER RING GEAR MOUNTING SURFACE AND PILOT "B" I.D. AND UPPER RING BOTTOM SURFACE HORIZ. FEED	BALANCE HOISE LOADER	N			PE								
	PLATE CARRIER SURFACE HORIZ. FEED													
	SECOND CHUCKING													
	MANUAL LOAD AND UNLOAD													
TOTALS						271,000	245,000	4,000	22,000	41,000				
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR. P. BOES	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLY. ENGR.	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLY. PLANNING VOLUME	REQ'D. PER VEHICLE RECHTS. PC/HR.	NEXT ASSY. SUPERSEDES. HRS.	OPER. NO. 20 B				



PROCESS ESTIMATE SHEET

PLANT		PART NAME COVER HOUSING						ISSUE DATES			DEPARTMENT					
PROJECT OR CCR NO.		MATERIAL CAST IRON						WT./RGM. FIN. LBS. 92 LB.			PART NO. D 926220		RELEASE		SHEET 4 OF 6	
FOR MODELS AZIMUTH DRIVE ASSEMBLY		TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER		MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST					
OPER. NO.	OPERATION DESCRIPTION						TOTAL	BASIC	FREIGHT	INSTAL- LATION	TOTAL	DESIGN	BUILD	INST. TRYS/JT	EXPENSE COST	
20	DRILL DRILL PROBE-1/16" AND PAP.	X10 - ROTARY 4 SPA. INDEX MACHINE		1-N	15	3.20		225,000			100,000					
	(4) GEAR BOX MOUNTING HOLES (1) OIL FILLER PLUG HOLE (16) BOLT MOUNTING HOLES (4) .125 DIA HOLES	(1) STA. LOAD & UNLOAD (2) STATIONS WITH TURRETS INCL. 5 POSITIONS. (1) OPEN STATION					247,500		3,500	19,000						
		GAGES		N			1,000			1,000	5,000					
	MANUALLY LOAD AND UNLOAD	BALANCE HOIST OVER HEAD RAIL TRACK		N		INC. IN MACH. CYC.		P. E.								
	MAKE CASTING AREA FOR NECESSARY REPAIRS.															
TOTALS								248,500	225,000	3,500	20,000	130,000				
REMARKS																
PROCESS ENGR. P. BOES		PLT. LAYOUT		AUTOMATION		DESIGN		MATL. HDLG. ENGR.		DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:		
INDUSTR. ENGR.		LAB.		QUAL. CONTR.		PLT. ENGR.		PRODN.		DAILY PLT. PLANNING VOLUME		REQMYS. PC/HR. HRS.		SUPERSEDES:		
Mfg. Development Engr. & Research														30		

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PROCESS ESTIMATE SHEET

PROGRAM OR CTR NO.		PART NAME				ISSUE DATES				DEPARTMENT					
FOR MODELS		MATERIAL				WT./RGH. FIN.				PART NO.					
AZIMUTH DRIVE ASSEMBLY						LBS.				RELEASE		SHEET 5 OF 6			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				DEPEND. COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRVCT		
	(OFF-TIME OPER.)														
R-45	REPAIR OPERATION	DRILL PRESS 2 1/2 SPINDLE	1-A		.15	27,500	25,000	500	2,000	50,000					
	NOTES & BURRS	SPE-E-1133-105													
	1.5% OF PRODUCTION 20 PCS.	GAGES				1,000			1,000	5,000					
	MANUAL LOAD & UNLOAD														
50	WASH RTHSE & DRY	3 STAGE WASHER ALSO USED FOR ALL MAJOR CASTING.	1-N	250	TRC MACH CYC.	214,000	200,000	4,000	10,000						
60	FINAL INSPECTION				IND. LAB	2,000			2,000	10,000					
70	PLACE IN CONTAINER AND SHIP TO ASSEMBLY AREA.	FORK LIFT TRUCK - MATERIAL HANDLING													
	PERSONAL RELIEF				.65										
TOTALS						10,40									
REMARKS						244,500	225,000	4,500	15,000	20,000					
	PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.						
	P. BOES								R-45						
	INDUSYR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:	50-60						

Mfg. Development  
Engrg. & Research

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PLANT

PROCESS ESTIMATE SHEET

DEPARTMENT

12

PROGRAM OR ECM NO. FORD AEROSPACE	PART NAME COVER HOUSING	ISSUE DATES	PART NO. D-926220
ICR MODELS AZIMUTH DRIVE ASSEMBLY	MATERIAL PLANT ENGINEERING REQUIREMENTS	WT./ LBS.    RGH.    FIN.	RELEASE    SHEET 6 OF 6

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	
1	CHIP - COOLANT AND CLARIFICATION SYSTEMS					61,000	45,000	1,000	15,000				
2	COOLANT REFRIGERATION SYSTEM												
3	EXHAUST - FUME - DUST AND VENTILATION												
4	CO2 FIRE PROTECTION SYSTEM												
5	MONORAIL CONVEYORS - OVERHEAD CONVEYOR					20,000	10,000		10,000				
6	MONORAIL CARRIERS (TOOLING)									5,000			
7	ROLLER CONVEYOR												
8	POWERED CONVEYORS												
9	PLATFORMS - STILES					13,000	10,000	1,000	2,000				
10	SERVICE PAILS AND HOISTS					10,000	5,000		5,000	6,000			
11	TOOL CABINETS - RACKS AND STANDS					3,000	2,000		1,000				
12	TOOL CONTROL BOARDS												
13	WORK - GAGING AND INSPECTION TABLES					8,000	5,000		3,000				
14	PARTS BASKETS (EXPENSE)												
15	PRODUCTION AIDS - ASSEMBLY AIDS												
16	SECONDARY LIGHTING					1,000	500		500				
17	PROGRAMMABLE CONTROLLERS												
18	AUTOMATION - PART HANDLING SYSTEM												
19	ENGINEERING SERVICES DESIGN - (EXPENSE)												10,000
20	BUILDING SERVICES - UTILITIES												
21	POWER AND FREE CONVEYOR SYSTEM												
22	POWER AND FREE CONVEYOR CARRIERS (TOOLING)												
23	MACHINE FOUNDATIONS AND DECKS												
24	PLANT REARRANGEMENT (EXPENSE)												
25	MATERIALS HANDLING - RACKS - CONTAINERS - DURRAGE												
	BUILDING CONSTRUCTION	3,200 SQ. FT.											

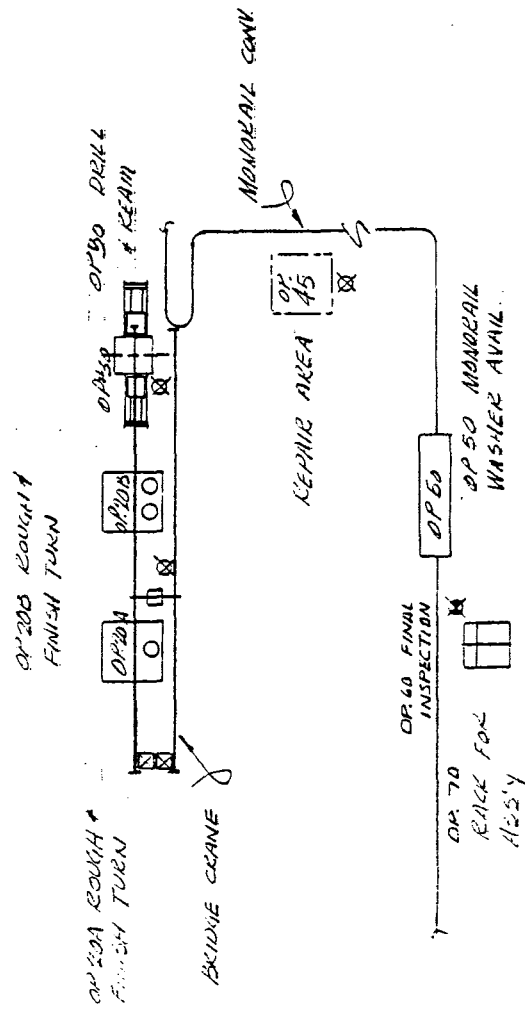
TOTALS						116,000	77,500	2,000	36,500	11,000			10,000
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REMARKS: TOTALS: FAC. - 986,000  
 TOOL - 237,000 G.T. 1,233,000  
 EXP. - 10,000

PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. HDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OTHER
INDUSTRIAL ENGR.	LAG.	QUAL. CONTR.	PLT. ENGR.	PRODUC.	DAILY PLT. PLANNING	RESULTS	SUPPLIERS	

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17



COVER HOUSING
PT# D-926220
NODULAR IRON

60/HR GROSS

PROCESS ESTIMATE SHEET

PROGRAM OR CER NO.		PART NAME			ISSUE DATES			DEPARTMENT						
HELICOPTAR		PLANET GEAR 3 PER ASS'Y.			8-29-80			PART NO. 936140						
FOR MODELS		MATERIAL			WT./	RGH.	FIN.	RELEASE		SHEET 1 OF 4				
50,000 AHL VOL. AZIMUTH DRIVE ASSY.		CAST IRON			LBS.	20.5								
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
10	ROUGH TURN	4 SPINDLE CHUCKING MACHINE	1	60	0.80	165,000	150,000	3,000	12,000	7,500				
	MANUAL LOAD & UNLOAD (1) PART													
	SPOT DRILL & CHAMFER FACE & CHAMFER													
	DRILL THRU & TURN HUB FOR PROCESS	GAGES				2,000	1,000		1,000	5,000				
	BORE THRU													
20	SEMI-FINISH TURN	2 SPINDLE TURNING MACHINE	1	68	0.72	121,000	110,000	2,000	9,000	5,000				
	MANUAL LOAD & UNLOAD (2 PARTS)													
	FACE & CHAMFER													
	TURN D. D.	GAGES				2,000	1,000		1,000	5,000				
TOTALS						290,000				22,500				
REMARKS														
PROC. ENGR. CALLIQUAN		PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY.		OPER. NO.				
INDUSTR. ENGR. S. THWIS		LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQ'TS.	SUPERSEDES:						
Mfg. Development Engrg. & Research							39 PC/HR. 16 HRS.							

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PROCESS ESTIMATE SHEET

PROGRAM OR CER NO.		PART NAME				ISSUE DATES				DEPARTMENT				
FOR MODEL		MATERIAL				WT. / RGM. FIN.				PART NO.				
AZIMUTH DRIVE ASSEMBLY						LBS.				RELEASE		SHEET 2 OF 4		
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRAVEL	
30	HOB GRG TEETH	HOBBIING MACHINE (160,000 EA) (1 MAN/3 MACHINES)	13	61.4	3.90	2,200,000	2,000,000	30,000	170,000	100,000				
		GAGES				6,000	3,000		3,000	30,000				
40	SHAVE GRG TEETH 8.2 P.D. 116 RPM - 420 REV. = 3.62 MIN. 15 16/HR/MACH. 3.77/GEAR	GEAR SHAVIER (1 MAN/2 MACH.)	4	64	1.50	378,000	340,000	5,000	30,000	144,000				
		GAGES				4,000	2,000		2,000	10,000				
50	DEBURR	DEBURRING MACHINE (1 MAN/2 MACH.)	2	60	.80	110,000	100,000	3,000	7,000	5,000				
TOTALS						2,698,000				289,000				
REMARKS														
Mfg. Development Engr. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:					

PROCESS ESTIMATE SHEET

PLANT		PROGRAM OR CCR NO.		PART NAME			ISSUE DATES		DEPARTMENT																					
				PLANET GEAR					PART NO. 936140																					
FOR MODELS		MATERIAL			WT./	RGH.	FIN.	RELEASE		SHEET 3 OF 4		EXPENSE COST																		
AZIMUTH DRIVE ASSEMBLY					LBS.																									
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST																				
						TOTAL	BASIC	FREIGHT	INSTALL-LAYON	TOTAL	DESIGN	BUILD	INST. BYCAT																	
65	WASH					AVAILABLE																								
66	HARDED GEAR	THINJECTION	1	100	.48	108,000	90,000			30,000																				
		HARDENER						3,000	15,000																					
		WITH QUENCHING SYSTEM																												
70	BORE T. D.	1-SPINDLE MACH.	1	60	.80	101,000	90,000	3,000	8,000	30,000																				
		GAGES				2,000	1,000		1,000	5,000																				
80	FINAL INSPECTION	GAGES			IND. LAB	6,000	3,000		3,000	40,000																				
90	WASH & DELIVERY TO ASSEMBLY	AVAIL.			THC. IN MACH. CYC.																									
	PERSONAL NETTER				.60																									
TOTALS					9.60	217,000				105,000																				
REMARKS																														
<table border="1"> <tr> <td>PROCESS ENGR.</td> <td>PLT. LAYOUT</td> <td>AUTONATION</td> <td>DESIGN</td> <td>MATL. MDLG. ENGR.</td> <td>DAILY SERVICE</td> <td>REQ'D. PER VEHICLE</td> <td>NEXT ASSY:</td> <td>OPER. NO.</td> </tr> <tr> <td>INDUSTR. ENGR.</td> <td>LAB.</td> <td>QUAL. CONTR.</td> <td>PLT. ENGR.</td> <td>PRODN.</td> <td>DAILY PLT. PLANNING VOLUME</td> <td>REQMTS. PC/HR. MRS.</td> <td>SUPERSEDES:</td> <td></td> </tr> </table>													PROCESS ENGR.	PLT. LAYOUT	AUTONATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.	INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. MRS.	SUPERSEDES:	
PROCESS ENGR.	PLT. LAYOUT	AUTONATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.																						
INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. MRS.	SUPERSEDES:																							

Strom Mfg. Development  
Engrg. & Research

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PROCESS ESTIMATE SHEET

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PROGRAM OR TECH NO.		PART NAME				ISSUE DATES				DEPARTMENT					
FORD AEROSPACE		PLANET GEAR								PART NO. 936140					
FOR MODELS		MATERIAL				WT./	RGH.	FIN.	RELEASE						
HELICOPTER, AZIMUTH DRIVE ASSEMBLY		PLANT ENGINEERING REQUIREMENTS				LBS.			SHEET 4 OF 4						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH' REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. BY VEHICLE		
1	CHTP - COOLANT AND CLARIFICATION SYSTEMS					410,000	300,000	10,000	100,000						
2	COOLANT REFRIGERATION SYSTEM														
3	EXHAUST - FUME - DUST AND VENTILATION														
4	CO <sub>2</sub> FIRE PROTECTION SYSTEM														
5	MONORAIL CONVEYORS	400'				80,000	40,000		40,000						
6	MONORAIL CARRIERS (TOOLING)	100								20,000					
7	ROLLER CONVEYOR					2,000	1,000		1,000						
8	POWERED CONVEYORS														
9	PLATFORMS - STILES														
10	SERVICE RAILS AND HOISTS														
11	TOOL CABINETS - RACKS AND STANDS					3,000	2,000		100						
12	TOOL CONTROL BOARDS														
13	WORK - GAGING AND INSPECTION TABLES	9				8,000	4,000		4,000						
14	PARTS BASKETS (EXPENSE)														
15	PRODUCTION AIDS - ASSEMBLY AIDS					8,000	5,000		3,000						
16	SECONDARY LIGHTING														
17	PROGRAMMABLE CONTROLLERS														
18	AUTOMATION - PART HANDLING SYSTEM														
19	ENGINEERING SERVICES DESIGN - (EXPENSE)													20,000	
20	BUILDING SERVICES - UTILITIES														
21	POWER AND FREE CONVEYOR SYSTEM														
22	POWER AND FREE CONVEYOR CARRIERS (TOOLING)														
23	MACHINE FOUNDATIONS AND DECKS														
24	PLANT REARRANGEMENT (EXPENSE)														
25	MATERIALS HANDLING - RACKS - CONTAINERS - DURNAGE														
TOTALS		BUILDING CONSTRUCTION 7,600 SQ. FT.													
						511,000				20,000				20,000	
REMARKS: (TOTALS: FAC. - 3,716,000 )															
TOOLIS - 436,500 ) \$4,172,500															
EXP. - 20,000 )															
	PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MOLD. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:		DAILY PLY. PLANNING		REQ'D. PER VEHICLE		OTHER COST	
	INDUST. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODM.			SUBASSEMBLY							

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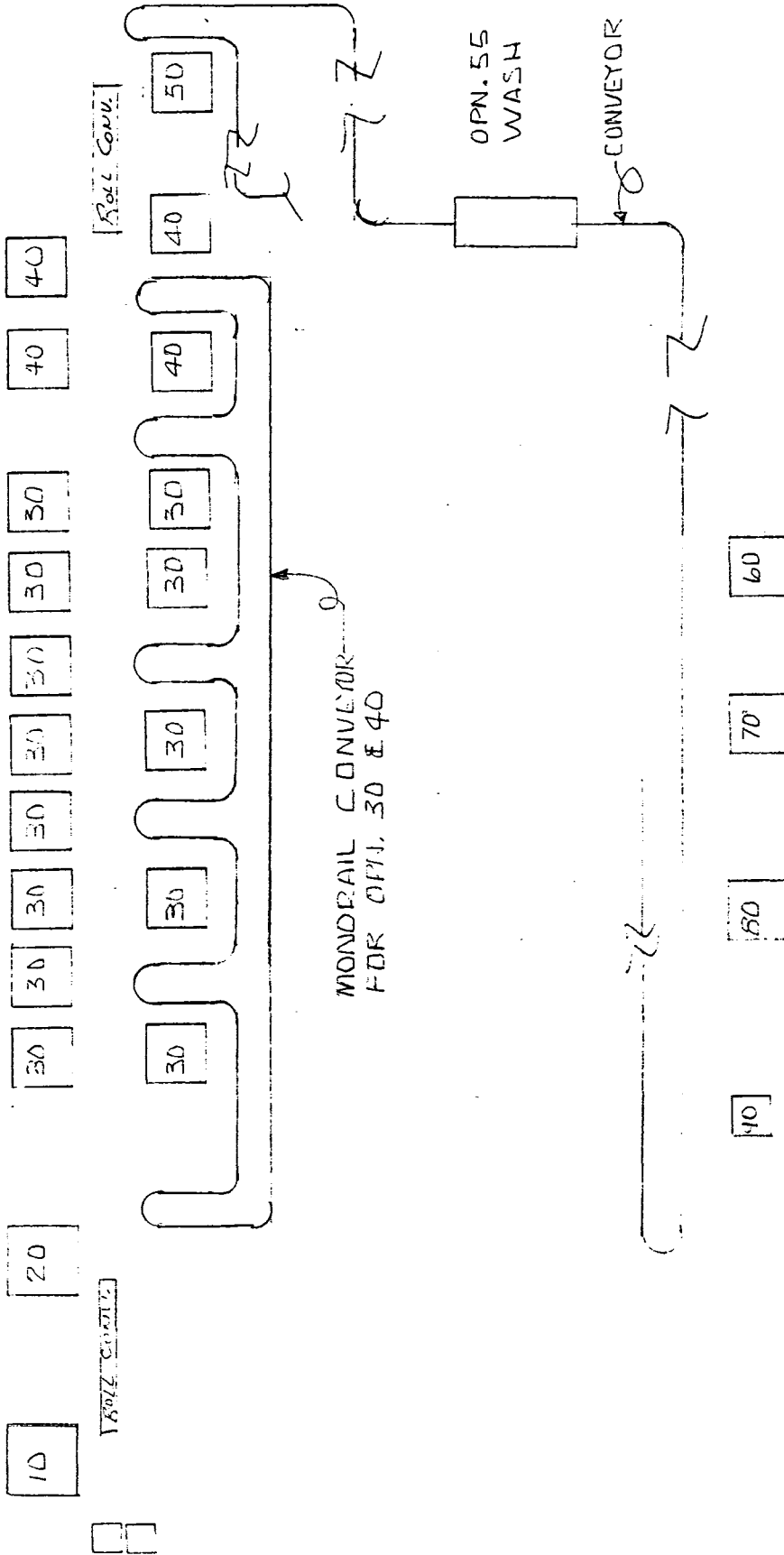
OPN. 10  
HARDEN & BLANK

OPN. 20  
HARDEN & BLANK

OPN. 50  
DEBURP

OPN. 30  
SHAVE TEETH

OPN. 40 - SHAVE  
GEAR TEETH



OPN. 50  
WASH & PLACE  
IN CONTAINER  
FOR DELIVERY  
TO ASSEMBLY

OPN. 60  
INDUCTION HARDEN  
GEAR TEETH

OPN. 70  
HONE I.D.

50.FT. = 7600  
PLANET GEAR  
036140

14

PROCESS ESTIMATE SHEET

PROGRAM OR CTR NO. HELIOSTAT		PART NAME PLANETARY FRAME				ISSUE DATES 3-17-80		DEPARTMENT PART NO. D-926310							
FOR MODELS AZIMUTH DRIVE ASSEMBLY		MATERIAL ANNEALED NODULAR IRON		WT./ LBS. 37	RGH.	FIN.	RELEASE	SHEET 1 OF 6							
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACH'S REVD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
5	REC. INSPECTION:														
	CHECK FOR SUFFICIENT MACHINING STOCK, SOUNDNESS OF CASTING, EXCESSIVE METAL GLASH, AND QUALITY OF CASTING.	GAGES	N		P.E.	1,000			1,000	5,000					
	CHECK DIMENSIONALLY EVERY THOUSANDTH CASTING, 100% TO CASTING B/PRINT.														
	MANUAL LOAD AND UNLOAD ONTO ROLLER CONVEYOR	ROLLER CONVEYOR SYSTEM THROUGHOUT ALL OPERATIONS	N												
TOTALS						1,000				5,000					
REMARKS															
Mfg. Development Engg. & Research		PROCESS ENGR. P. BOES	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MOLDG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
		INDUSTR. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. 16 PC/HR. 16 HRS.	SUPERSEDES:	5					

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PROCESS ESTIMATE SHEET

PLANT _____		PROGRAM OR ECR NO. HELIOSTAT					PART NAME PLANETARY FRAME				ISSUE DATES 4-16-60			DEPARTMENT: PART NO. D-926310		
FOR MODELS AZIMUTH DRIVE ASSEMBLY		MATERIAL NODULAR IRON				WT./ LBS. 37		RGH. FIN.		RELEASE			SHEET 2 OF 6			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER REQ.	MACH. REQ.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST		
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INT. PAYGT			
	BIN 140-190															
10A	ROUGH AND FINISH TURN AND CHAMFER TOP SURFACE	BULLARD 25" TCA TWIN SPINDLE FIXED TOOLING CHUCKING MACHINE.	I-N	29	1.67	220,000	200,000	3,000	17,000	70,000						
	PILOT 7.75 & OUTSIDE DIAS. FOR MPG. LOCATION AND CHAMFER (2) PLACES															
		GAGES								10,000						
10B	UNLOAD POS. #2 FINISHED PART ONTO CONVEYOR. ROTATE PART FROM POS. #1 WITH DEMACHINED SURFACE UP INTO POS. #2.	TILT STAND			P.E.											
	LOAD RAW STOCK INTO POS. #1															
	ROUGH AND FINISH TURN BOTTOM SURFACE AND CHAMFER (2) PLACES															
	MANUAL LOAD AND UNLOAD															
TOTALS						220,000				80,000						
REMARKS																
Mfg. Development Engrg. & Research		PROCESS ENGR. P. BOES	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME	REQ'D. PER VEHICLE 16	PC/HR. 16	MRS.	NEXT ASSY: SUPERSEDES:	OPER. NO. 10				

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14

PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO. HELIOSTAT		PART NAME PLANETARY FRAME				ISSUE DATES				DEPARTMENT				
FOR MODELS AZIMUTH DRIVE ASSEMBLY		MATERIAL NODULAR IRON				WT./RGH. FIN. LBS. 37				PART NO. D926310		RELEASE SHEET 3 OF 6		
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.F. NUMBER	MACH'S RECD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRV/21	
20	ROUGH AND FINISH STRADDLE MILL (3) GEAR POCKETS	4 STA. ROTARY INDEX MACHINE INDEXING FIXTURES	I-N	56	0.86	262,000	240,000	4,000	18,000	175,000				
		KLO-BAMMESBURG TYPE MACHINE OR KINGSBURY												
		GAGES	N		P.E.	1,000			1,000	13,000				
	MANUAL LOAD AND UNLOAD													
	PLANET CARRIER GEAR POCKETS MUST BE INDEXED (3) TIMES @ 120° EACH BEFORE MACHINE HAS COMPLETED ITS CYCLE.													
TOTALS						263,000				188,000				
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR. II. BOES	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMYS. PC/HR.	SUPERSEDES:	20				

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PROCESS ESTIMATE SHEET

PLANT		PROGRAM OR ECR NO. HELIOSTAT								PART NAME PLANETARY FRAME				ISSUE DATES				DEPARTMENT			
FOR MODELS AZIMUTH DRIVE ASSEMBLY		MATERIAL MODULAR IRON								WT./ 37 RGH. FIN. LBS.				PART NO. D926310				RELEASE SHEET 4 OF 6			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST							
						TOTAL	BASIC	FREIGHT	INSTAL- LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT								
30	STA. #1 DRILL (3) HOLES UNDER SIZE TOP AND BOTTOM	KINGSBURY 4 STA. ROTARY INDEX MACHINE	I-N	50	0.96	222,000	200,000	4,000	18,000	75,000											
	STA. #2 DRILL (3) HOLES TOP AND BOTTOM SURFACES																				
	STA. #3 ROUGH AND FINISH BORE (COMMON BAR) (3) BEARING HOLES INLINE	GAGES	N		P.E.	1,000			1,000	3,500											
	STA. #4 LOAD AND UNLOAD																				
TOTALS						223,000				78,500											
REMARKS																					
Mfg. Development Engrg. & Research		PROCESS ENGR. P. BOES	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO. 40											
		INDUSTYR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:												

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PROCESS ESTIMATE SHEET

PROGRAM OR EEA NO. HELIOSTAT		PART NAME PLANETARY FRAME				ISSUE DATES				DEPARTMENT: PART NO. D-926310				
FOR MODELS AZIMUTH DRIVE ASSEMBLY		MATERIAL MODULAR IRON				WT./ LBS.				RELEASE		SHEET 5 OF 6		
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTAL- LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
40	WASH-RINSE AND DRY	3-STAGE WASHER ALSO USED FOR ALL MAJOR CASTINGS.	A	250	0.20	AVAILABLE								
	MANUAL LOAD AND UNLOAD	MONORAIL CONVEYOR MONORAIL CARRIERS			P.E. P.E.									
50	AUTO. GAGE BORE DIAS. - FOR SIZE	ELECTROCOLUMN MULTIPLE AUTO. GAGE UNIT AA GAGE	I-N	20	P.E.	5,000			5,000	15,000				
	MANUAL LOAD AND UNLOAD													
R55	REPAIR AREA 3% OF PRODUCTION	GENERAL REPAIR AREA			0.11	2,000			2,000	10,000				
	RECYCLE THUR OP. #50													
60	PLACE IN PROTECTIVE CONTAINER AND SHIP TO ASSEMBLY	SHUTTLE SYSTEM			0.25									
	PERSONAL RELIEF				0.27									
TOTALS					4.32	7,000				25,000				
REMARKS														
Mfg. Development Engg. & Research		PROCESS ENGR. P. BOES	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MOLDG. ENGR. PRODM.	DAILY SERVICE DAILY PLT. PLANNING VOLUME	REQ'D. PER VEHICLE RECHTS. PC/HR.	NEXT ASSY: SUPERSEDES:	OPER. NO. 40-50 R55-60				

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PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR CCM NO. HELIOSTAT	PART NAME PLANETARY FRAME	ISSUE DATES	PART NO. D-926310
FOR MODELS AZIMUTH DRIVE ASSEMBLY	MATERIAL PLANT ENGINEERING REQUIREMENTS	WT./ LBS.	RGH. FIN.
		RELEASE	SKIT 6 OF 6

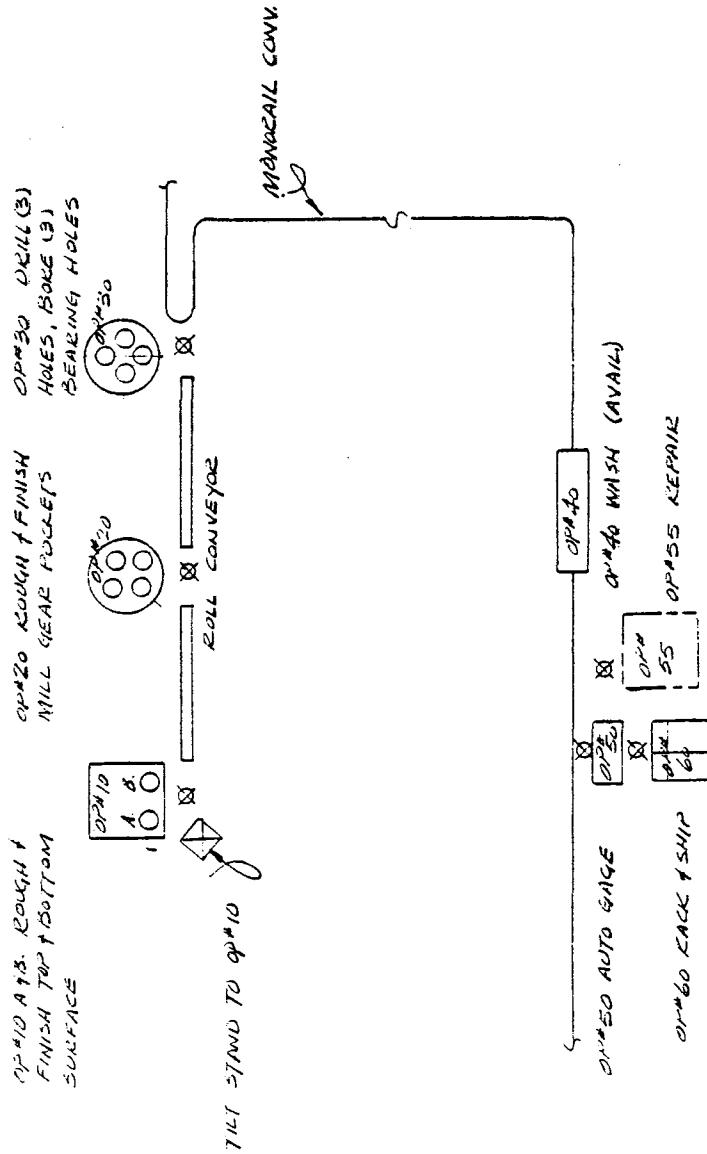
14

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S RECD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			ESTIM. COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	
1	CHP - COOLANT AND CLARIFICATION SYSTEMS					61,000	45,000	1,000	15,000				
2	COOLANT REFRIGERATION SYSTEM												
3	EXHAUST - FUME - DUST AND VENTILATION												
4	RCF FIRE PROTECTION SYSTEM												
5	MICROFIL CONVEYORS					40,000	20,000		2,000				
6	MICROFIL CARRIERS (TOOLING)									5,000			
7	ROLLER CONVEYOR					5,000	3,000		2,000				
8	POWERED CONVEYORS												
9	PLATFORMS - STILES												
10	STORAGE RAILS AND HOISTS					6,000	3,000		3,000	1,000			
11	TOOL CABINETS - RACKS AND STANDS					3,000	2,000		1,000				
12	TOOL CONTROL CARDS												
13	WORK - GAGING AND INSPECTION TABLES					8,000	5,000		3,000				
14	WORK BASKETS (EXPENSE)												
15	PRODUCTION AIDS - ASSEMBLY AIDS					8,000	6,000		2,000				
16	SECONDARY LIGHTING												
17	PROGRAMMABLE CONTROLLERS												
18	AUTOMATION - PART HANDLING SYSTEM												
19	ENGINEERING SERVICES DESIGN - (EXPENSE)												10,000
20	BUILDING SERVICES - UTILITIES												
21	POWER AND FREE CONVEYOR SYSTEM												
22	POWER AND FREE CONVEYOR CARRIERS (TOOLING)												
23	MACHINE FOUNDATIONS AND DECKS												
24	PLANT REARRANGEMENT (EXPENSE)												
25	MATERIALS HANDLING - RACKS - CONTAINERS - DUNNAGE												
	BUILDING CONSTRUCTION	3,200 SQ. FT.											
TOTALS						131,000				6,000			10,000

REMARKS TOTALS: F - 845,000 }  
 T - 382,500 } \$1,237,500  
 P - 10,000 }

PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATE. HDLS. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	HEAT ASSY.
					DAILY PLT. PLANNING	INSTR.	

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SAFT REQ'D - 3200

PLANET CARRIER HOUSING PT# D-926310 ANNEALED NODULAR IRON
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PROCESS ESTIMATE SHEET

715

PROGRAM OR ECR NO. HELIOSTAT FOR MODEL 1 AZIMUTH DRIVE ASSEMBLY		PART NAME PRIMARY RING GEAR			ISSUE DATES 4-21-80			DEPARTMENT PART NO. D-936710							
MATERIAL MODULAR CASTING		WT./ LBS.	RGH. 95	FIN.	RELEASE		SHEET 1 OF 9								
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. (BY/CY)		
5.	REC. INSPECTION				IND. LAB										
	CHECK FOR SUFFICIENT MACHING STOCK	GAGES	N			2,000	1,000		1,000	4,000					
	COMPLESS OF CASTING, EXCESSIVE METAL FLASH, AND QUALITY OF CASTING														
	CHECK DIMENSIONALLY EVERY THOUSANDTH CASTING, LOOK TO CASTING BLUE PRINT														
	POWER NOISE														
	MANUAL LOAD AND UNLOAD ONTO ROLLER CONVEYOR.	ROLLER CONVEYOR SYSTEM THROUGH OUT ALL OPERATIONS			INC. IN MACH. CYC.										
TOTALS						2,000				4,000					
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR. P. BOES	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME 208	REQ'D. PER VEHICLE 1 16PC/HR. 16 HRS.	NEXT ASSY: SUPERSEDES:	OPER. NO. 5					

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PROCESS ESTIMATE SHEET

PROGRAM OR CER NO.		PART NAME				ISSUE DATES			DEPARTMENT					
FOR MODEL		MATERIAL				WT./	RGH.	FIN.	PART NO.		SHEET		OF	
AZINUTH DRIVE ASSEMBLY		NODULAR IRON				LBS.	95		D-936710		2		9	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR D.T. NUMBER	MACH'S REQ.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRV CAT	
	BHN 140 - 190													
	FIRST CHUCKING POSITION	BULLARD 25" TCA	1-N	11.7	4.11		200,000				70,000			
10	ROUGH AND FINISH TURN	TWIN SPINDLE	1-N	11.7			200,000				70,000			
A	BASE MOUNTING SURF.	FIXED TOOLING CHUCKING MACH.					220,000		3,000	17,000				
	PILOT 20.500 O.D. AND SHOULDER						220,000		3,000	17,000				
	GEAR 17.748/17.750 I.D.													
		GAGES	N								12,000			
10	SECOND CHUCKING POS.				INC. IN		3,000	1,000		1,000				
B	ROUGH TURN GEAR				FIRST									
	POCKET 21.156 I.D. AND BOTTOM SURFACE AND "O" RING EDGE SURFACE.													
	ROUGH AND FINISH FORM TURN BALL GROOVE INSIDE DIA.													
		POWER HOIST												
	MANUAL LOAD AND UNLOAD													
TOTALS							442,000				152,000			
REMARKS														
		PROCESS ENGR. P. BOES	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO.			
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	RECHTS. PC/HR. HRS.	SUPERSEDES:		10			

Mfg. Development Engr. & Research

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PROCESS ESTIMATE SHEET

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PROGRAM OR ECR NO.		PART NAME				ISSUE DATES				DEPARTMENT				
FOR MODELS AZIMUTH DRIVE ASSEMBLY		MATERIAL				WT. / LBS.    RGH.    FIN.				PART NO. D-936710				
										RELEASE		SHEET 3 OF 9		
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRVOLT	
20	MACHINE (1) BALL HOLE	AUTO. BURGMASER HYDRAULIC	1-N	20.	2.40		52,000				15,000			
	SPOTDRILL	TURRET MACHINING CENTER				57,000		1,000	4,000					
	HAMMER 30° INCL. ANG. 10" RING SEAT	GAGES	N			1,000			1,000	1,200				
	PROBE													
	TAP 3/4-16 THRD.													
		POWER HOIST	N											
	LOCATE FROM BALL GROOVE FOR LOCATING PART.													
	MANUAL LOAD AND UNLOAD													
TOTALS						58,000				16,200				
REMARKS														
Mfg. Development Engg. & Research		PROCESS ENGR. P. BOES	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. HDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTY. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/NR.    HRS.	SUPERSEDES:	20				

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PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO.		PART NAME				ISSUE DATES			PART NO.					
FOR MODELS AZINIFTH DRIVE ASSEMBLY		MATERIAL				WT./	RGH.	FIN.	D-936710		SHEET 4 OF 9			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD		INST. TAYOUT
30	SUB-LAND DRILL AND CHAMFER AND TAP (18) 1/2-13 BOLT HOLES	MATCO 36 SPINDLE MULTIPLE DRILLING MACH. SHUTTLE TABLE (2) POSITIONS T-425 MOD.	1-N	40	1.20		150,000				30,000			
		GAGES	N			2,000	1,000		1,000	3,000				
		POWER HOIST	N											
	MANUAL LOAD AND UNLOAD													
	RADIALLY LOCATE FROM BALL SEAT HOLE.													
TOTALS							167,000			33,000				
REMARKS														

PROCESS ENGR. P. BOES	PLY. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLY. ENGR.	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLY. PLANNING VOLUME	REQ'D. PER VEHICLE REQNTS. PC/HR.	NEXT ASSY: SUPERSEDES:	OPER. NO. 30
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Mfg. Development  
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PROCESS ESTIMATE SHEET

PLANT		DEPARTMENT													
PROGRAM OR CER NO.		PART NAME					ISSUE DATES			PART NO.					
FOR MODELS		MATERIAL					WT./RGH. FIN. LBS.			RELEASE		SHEET 5 OF 9			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INIT. TRYOUT		
40	SHAPE 179 GEAR TEETH - ROUGH AND FINISH PASS	FELLOWS GEAR SHAPER	4-N	4.85	19.4 PCS	660,000	600,000	12,000	18,000	200,000					
					2.50	(1 MAN - 4 MACH.)									
	RADIALLY LOCATE PART FROM BALL SEAT HOLE														
	HANDUALLY LOAD AND UNLOAD	POWER HOIST													
						(1 MAN - 2 MACH.)									
50	GEAR SHAVE 179 INTERNAL TEETH	RED RING MODEL GCX-24" GEAR SHAVING MACH.	2-N	10	2.40	400,000	370,000	6,000	24,000	40,000					
						GAGE EQUIPMENT COST SHOWN ON PART NO. 936840									
	HANDUALLY LOAD AND UNLOAD	POWER HOIST GAGES													
60	DEBURR SHARP EDGES ON TOP AND BOTTOM OF GEAR TEETH SURFACES.	MURRAY WAY WIRE BRUSH MACHINE 3 STA.	1-N	25	1.94	132,000	120,000	2,000	10,000	35,000					
	HANDUALLY LOAD AND UNLOAD	POWER HOIST													
TOTALS						1,192,000				275,000					
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR. P. HOES	PLT. LAYOUT LAB.	AUTOMATION	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO. 40	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR.	SUPERSEDES: NRS.	50-60	

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**PROCESS ESTIMATE SHEET**

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PLANT _____		<b>PROCESS ESTIMATE SHEET</b>						DEPARTMENT _____						
PROGRAM OR CTR NO.		PART NAME				ISSUE DATES		PART NO.						
FOR MODELS AZIMUTH DRIVE ASSEMBLY		MATERIAL		WT./LBS.	RGH.	FIN.	D-936710		RELEASE	SHEET 6 OF 9				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR D.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYS/CT	
70	WASH-RINSE & DRY	3 STAGE WASHER	A	2.50	0.20	P. E.	AVAILABLE							
		ALSO USED FOR ALL MAJOR CASTINGS.					IN CENTRAL AREA WITH MONORAIL CONVEYOR SYSTEM							
	MANUAL LOAD AND UNLOAD.	POWER HOIST	N			AVAIL.								
TOTALS														
REMARKS														
		PROCESS ENGR. P. BOES	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME	REQ'D. PER VEHICLE PC/HR.	REQ'TS. HRS.	NEXT ASSY: SUPERSEDES.	OPER. NO. 70			

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PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO.		PART NAME				ISSUE DATES		DEPARTMENT						
FOR MODELS		MATERIAL			WT./LBS.	RGH.	FIN.	PART NO.		RELEASE	SHEET	OF		
AZIMUTH DRIVE ASSEMBLY								D-936710			7	9		
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.Y. NUMBER	MACH'S RECD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
80	INDUCTION HARDEN GEAR TEETH 179	TOCCO 100 K.W. INDUCTION HEATING SYSTEM AND WATER QUENCH EQUIPMENT.	1-N	100	0.48	88,000	70,000	3,000	15,000	30,000				
	MANUAL LOAD AND UNLOAD	POWER HOIST												
90	POLISH BALL TRACK RADIUS SURFACE	MURRAY WAY POLISHING MACH.	1-N	36	1.33	99,000	90,000	2,000	7,000	15,000				
	MANUAL LOAD AND UNLOAD	POWER HOIST												
100	VISUALLY INSPECT 100 PER CENT PER-CENTAGE CHECK 1% OF PRODUCTION RATE, ALL CRITICAL DIMENSIONS. TAG REJECTS	GAGES	N			2,000	1,000		1,000	35,000				
TOTALS						89,000				80,000				
REMARKS														
Mfg. Development Engng. & Research		PROCESS ENGR. P. BOES	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME	REQ'D. PER VEHICLE	RECMTS. PC/NR. HRS.	NEXT ASSY: SUPERSEDES:	OPER. NO. 80-90 100			

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PROCESS ESTIMATE SHEET

PROGRAM OR P.C.R. NO.		PART NAME				ISSUE DATES			DEPARTMENT				
FOR MODELS		MATERIAL			WT./LBS.	RGH.	FIN.	PART NO.		RELEASE		SHEET 8 OF 9	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	WST. TRYOUT
R-10	GENERAL - REPAIR	GENERAL REPAIR	N							35,000			
	AREA FOR SIX MAJOR MODULAR IRON CASTING COMPONENTS	AREA				93,000	85,000	2,000	6,000	1,000			
	RECYCLE THRU OPER #70 AND #80 ONLY	BENCHES	3-N										
110	PLACE IN PROTECTIVE CONTAINER AND SHIP TO ASSEMBLY				0.25								
	PERSONAL RELIEF				1.13								
TOTALS					17.94								
REMARKS						93,000				36,000			
	PROCESS ENGR.	PLY. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASBY:		OPER. NO.			
	P. BOES	LAB.	QUAL. CONTR.	PLY. ENGR.	PRODN.	DAILY PLY. PLANNING VOLUME	REQMTS. PC/HR.	HRS.		R-105			
Stm	Mfg. Development Engrg. & Research							SUPERSEDES:		110			

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PROCESS ESTIMATE SHEET

DEPARTMENT: \_\_\_\_\_

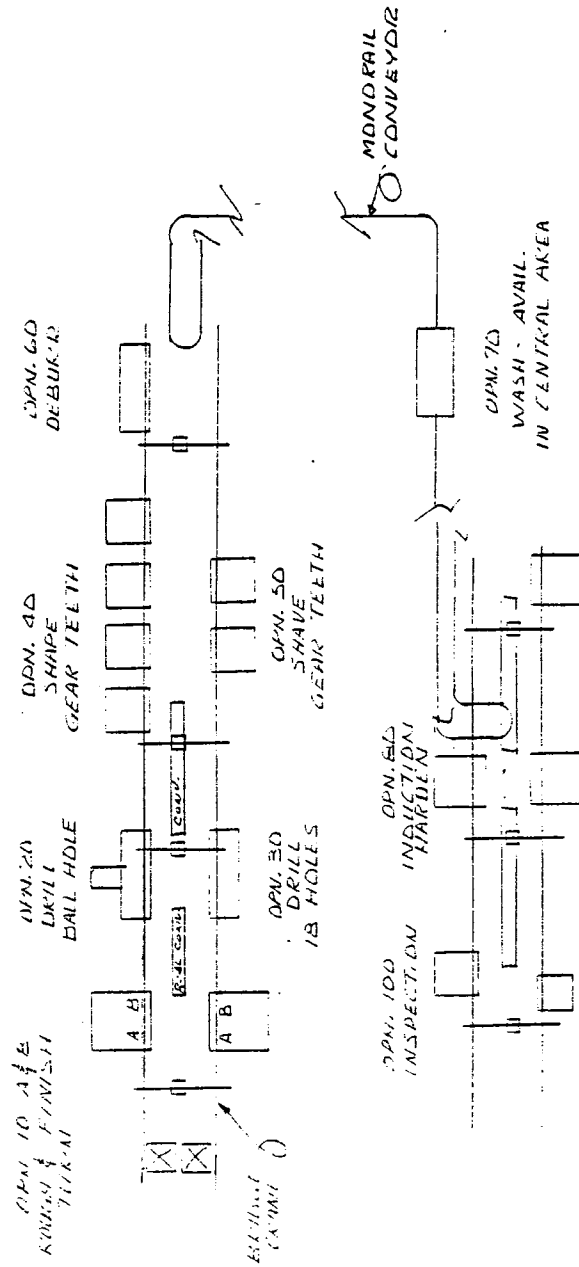
PROGRAM OR ECM NO. HELIOSTAT	PART NAME PRIMARY RING GEAR	ISSUE DATES	PART NO. D-936710
FOR MODELS EARTH AIRSPACE, AZIMUTH DRIVE ASSEMBLY	MATERIAL PLANT ENGINEERING REQUIREMENTS	WT./ LBS.	RGH. FIN.
		RELEASE	SKETCH 9 OF 9

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. COST
1	CHIP - COOLANT AND CLARIFICATION SYSTEMS					205,000	150,000	5,000	50,000				
2	STIGANT REFRIGERATION SYSTEM												
3	EXHAUST - FUMS - DUST AND VENTILATION												
4	CCP FIRE PROTECTION SYSTEM												
5	MONORAIL CONVEYERS					40,000	20,000		20,000				
6	MONORAIL CARRIERS (TOOLING)									10,000			
7	ROLLER CONVEYOR					10,000	7,000		3,000				
8	POWERED CONVEYERS												
9	PLATFORMS - STILLS												
10	SERVICE RAILS AND ROISTS					63,000	30,000	3,000	30,000	10,000			
11	TOOL CABINETS - RACKS AND STANDS					5,000	4,000		1,000				
12	TOOL CONTROL BOARDS												
13	WORK - GAGING AND INSPECTION TABLES					8,000	5,000		3,000				
14	PARTS BASKETS (EXPENSE)												
15	PRODUCTION AIDS - ASSEMBLY AIDS												
16	SECONDARY LIGHTING					1,000	500		500				
17	PROGRAMMABLE CONTROLLERS												
18	AUTOMATION - PART HANDLING SYSTEM												
19	ENGINEERING SERVICES DESIGN - (EXPENSE)												
20	BUILDING SERVICES - UTILITIES												10000
21	POWER AND FREE CONVEYOR SYSTEM												
22	POWER AND FREE CONVEYOR CARRIERS (COOLING)												
23	MACHINE FOUNDATIONS AND DECKS												
24	PLANT REARRANGEMENT (EXPENSE)												
25	MATERIALS HANDLING - RACKS - CONTAINERS - DUNNAGE												
	BUILDING CONSTRUCTION	4400 SQ. FT.											
<b>TOTALS</b>						332,000				20,000			10,000

REMARKS	DESIGN COST	PLT. LAYOUT	AUTOMATION	DESIGN	MATE. HBLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	HEAT ASSY.	OPERATION
	TOTAL COST		TOTAL COST	PER VEHICLE	PER VEHICLE	DAILY PLT. PLANNING	PER VEHICLE	PER VEHICLE	

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50 FT REQ'D - 4400

PRIMARY RING GEAR

D-936710

MODULAR IRON

OPN. 70.5 K  
 REMOVE FROM MONORAIL CONVEYOR  
 AFTER WASH - PLACE IN RACK &  
 DELIVER TO OPN. 80 - WITH FORK LIFT  
 TRUCK - CONVEYOR DELIVERY IS  
 TOO SLOW.

PROCESS ESTIMATE SHEET

PLANT _____		DEPARTMENT _____													
PROGRAM OR ECR NO. HET.EG.S74P		PART NAME OUPPUP RING GEAR (SECONDARY)				ISSUE DATES 2-7-80		PART NO. 936440							
FOR MODELS 50,000/YEAR NET, AZIMUTH DRIVE ASSY.		MATERIAL ASSUMED: FORGED OR RING ROLLIED SAE 4150		WT./ LBS.	RGH. 44.0	FIN.	RELEASE	SHEET 1 OF 7							
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				DEPEND. COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRVCL		
10	ROUGH TURN:  MOUNTING FACE & PILOT DIA.  OPPOSITE DIAMETER (O.D.)  THE WORK PTECE IS MANUALLY LOADED & UNLOAD TO THE MANUALLY ACTUATED POWER CHUCK. THE CHUCK HAS SPECIAL JAWS AND LOCATTION PADS FOR THIS WORK PTECE.	VERTICAL (1) SPINDLE AUTOMATIC LATHE	1	20	2.40	220,000	200,000	3,000	17,000	60,000					
		SET-UP GAGES	LOT			4,000	2,000		2,000	10,000					
		POWER HOIST													
20	ROUGH TURN:  OPPOSITE FACE  PISTON DIAMETER (I.D.)  TRACE BALL TRACK  LOCATE ON MOUNTING FACE - LOCATE AND CHECK ON PILOT DIAMETER	VERTICAL (1) SPINDLE AUTOMATIC LATHE	1	21	2.30	220,000	200,000	3,000	17,000	60,000					
		SET-UP GAGES	LOT			4,000	2,000		2,000	10,000					
TOTALS						448,000				140,000					
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
		INDUSTR. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESTAN	PRODN.	DAILY PLT. PLANNING VOLUME	REQ'TS. PC/HR. HRS.	SUPERSEDES.						

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PROCESS ESTIMATE SHEET

PLANT		PROGRAM OR CCR NO.		PART NAME		ISSUE DATES		DEPARTMENT							
		HELIOS/PAP		OUTPUT RING GEAR (SECONDARY)		2-7-80		PART NO.							
FOR MODELS		MATERIAL		WT./		RGH.		FIN.							
50,000 PER YEAR NET- AZIMUTH DRIVE ASSEMBLY				LBS.				RELEASE SHEET 2 OF 7							
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR D.T. NUMBER	MACH. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				DEPEND. COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
30	DRILL & TAP (8) HOLES:														
	SPOT DRILL AND CHAMFER (8) PLACES			128	.38										
	DRILL (8) HOLES			48	1.00										
	TAP (8) HOLES			96	.50										
	- THE GEAR IS MANUALLY POSITIONED (POS.) INTO THE FIXTURE & SECURED IN PLACE	HEAVY DUTY SEMI-AUTO. VERTICAL DRILL PRESS WITH SPECIAL MULTI-SPLINDLE HEADS AND BUSHING PLATES.	3			66,000	60,000	1,500	4,500	100,000					
	- THE FIXTURE IS MANUALLY POS. UNDER THE SPLINDLES														
	- THE BUSHING PLATE - HEAD IS ENGAGED TO FIXTURE MANUALLY	WORK PIECE HOLDING PALLET FIXTURES	6		INC. IN MACH. CYCLE					25,000					
	- THE MACHINE FEED IS ACTUATED TO INITIATE THE AUTOMATIC PORTION OF THE CYCLE.	ROLLER CONVEYOR													
	- THE FIXTURE IS MANUALLY MOVED, VIA CONVEYOR TO THE NEXT DRILL PRESS	SET-UP GAGES				1,000	2,000		2,000	10,000					
		POWER HOIST													
TOTALS															
REMARKS															
						70,000				135,000					
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
		INDUST. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HRS.	SUPERSEDES. HRS.						

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PLANT 20 PER HR. GROSS REQ'D

PROCESS ESTIMATE SHEET

DEPARTMENT: \_\_\_\_\_

PROGRAM OR ECH NO. HELICOPTER	PART NAME OUTER RING GEAR (SECONDARY)	ISSUE DATES 2-7-80	PART NO.
FOR MODELS AZIMUTH DRIVE ASSEMBLY	MATERIAL	WT./ LBS.	RGH. FIN.
		RELEASE	SHEET 3 OF 7

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INIT. TRVCT	
	- THE FIXTURE IS MOVED THROUGH THE NEXT 2 DRILL PRESSES IN THE SAME SEQUENCE.				THC. IN MACH. CYCLE									
	- THE PART IS REMOVED FROM THE FIXTURE AND LOADED TO SHIPPING RACK				.20									
	EXP. M.C.P. - 1st POS. - .30 MIN.													
	- 2nd POS. - .80 MIN.													
	- 3rd POS. - .40 MIN.													
40	AUDIT INSPECTION	GAGRS	LAP		TND. LAB	4,000	2,000		2,000	15,000				
TOTALS										4,000	15,000			

REMARKS \_\_\_\_\_

PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.
INDUST. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR.	SUPERSEDES. HRS.	

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Engr. & Research

PROCESS ESTIMATE SHEET

PROGRAM OR CR. NO.		PART NAME				ISSUE DATES				DEPARTMENT				
HELICOPTER		OUTPUT RING GEAR (SECONDARY)				2-7-80				PART NO.				
FOR MODELS		MATERIAL				WT. / RGH. FIN.				RELEASE		SHEET 4 OF 7		
50,000 PER YEAR DEP -- ASSEMBLY		AZIMUTH DRIVE												
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQ.	GROSS WEX HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRVQ. CT	
50	FINISH THROTTLE	1-VERTICAL SPINDLE PRECISION TURNING & BORING MACHINE	1	50	.96	220,000	200,000	3,000	17,000	60,000				
	T.D.													
	HOUFFING FACE	POWER HOIST												
	PTT/P DIA													
	BALL TRACK													
	MANUAL LOAD & UNLOAD RING TO POWER CHUCK				INC. IN MACH. CYC.									
	LOCATE ON OPP. FACE - LOCATE & STAMP ON O.D.													
		SET-UP GAGES	OP			4,000	2,000		2,000	10,000				
60	AUDIT INSPECTION	GAGES	OP		IND. TAB	4,000	2,000		2,000	15,000				
TOTALS						228,000				85,000				
REMARKS														
Mfg. Development Eng. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE		REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO.		
		INDUST. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME		RECHTS.	SUPERSEDES:				
									PC/HR.	HRS.				

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PROCESS ESTIMATE SHEET

PROGRAM OR CTR NO.		PART NAME				ISSUE DATES				DEPARTMENT				
BELT DRIVE		GUPPUP RING GEAR (SECONDARY)				2-8-80				PART NO.				
FOR MODELS		MATERIAL		WT./		RGH.		FIN.		RELEASE		SHEET 5 OF 7		
50,000/YEAR REP - AZIMUTH DRIVE ASSEMBLY				LBS										
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQS.	GROSS 85% HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. BY CAT	
70	SHAVE GEAR TEETH	GEAR SHAPER	1.4	19.4	2.47	649,000	600,000	9,000	40,000	200,000				
	1 ROUGH COP													
	1 FINISH COP	POWER HOIST												
80	DEBORR	DEBORR & CHAMFER MACHINE	1	30	1.60	110,000	100,000	2,000	8,000	25,000				
	MANUAL LOAD & UNLOAD													
		POWER HOIST												
90	SHAVE GEAR TEETH	GEAR SHAVER	1.2	20	2.40	385,000	360,000	6,000	20,000	30,000				
	MANUAL LOAD & UNLOAD													
	AUTO. CYCLE	POWER HOIST												
100	WASH	AVAILABLE			TMC, TM MACH. CYC.									
110	INSPECTION & MARK PARTS	GAGES HAND TOOLS	LOT LOT		IND. IAB	4,000	2,000		2,000	10,000				
										1,000				
TOTALS						1,148,000				266,000				
REMARKS														
Mfg. Development		PROCESS ENGR.	PLY. LAYOUT	AUTOMATION	DESIGN	NATL. MDLG. ENGR.	DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:		OPER. NO.	
Engng. & Research		INDUSTY. ENGR.	LAB.	QUAL. CONTR.	PLY. ENGR.	PRODN.	DAILY PLY. PLANNING VOLUME		REQ'TE. PC/HR. HRS.		SUPERSEDES:			

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PROCESS ESTIMATE SHEET

PROGRAM OR CTR NO. HELICOPTAR		PART NAME OUTPUT RING GEAR (SECONDARY)				ISSUE DATES 2-8-80		DEPARTMENT PART NO.							
FOR MODELS 50,000 PER YEAR HEP-		AZIMUTH DRIVE ASSEMBLY		MATERIAL		WT./ LBS.	RGH.	FIN.	RELEASE	SHEET 6 OF 7					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTAL- LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
130	HEAT TREAT				INC. IN HEAT TREAT SYSTEM	REF. PT. #	PLANET GEAR			30,000					
	INDUCTION HARDEN GEAR TEETH		1	100											
	INDUCTION BALL TRACK														
	BURNISH RIM														
130	POLISH BALL TRACK	POLISHING MACHINE	1	20	2.40	88,000	80,000	1,500	6,500	30,000					
		POWER HOIST													
140	ADPT INSPECTION	GAGES	OT		IND. LAB	24,000	5,000	4,000	15,000	235,000					
		POWER HOIST													
150	DELIVER TO ASSEMBLY PERSONAL RELIEF	MATERIAL HANDLING			IND. LAB	1.11									
TOTALS															
REMARKS						112,000				295,000					
		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLY. PLANNING VOLUME	REQ'TS. PC/HRS. HRS.	SUPERSEDES:						

5148 Mfg. Development  
Engg. & Research

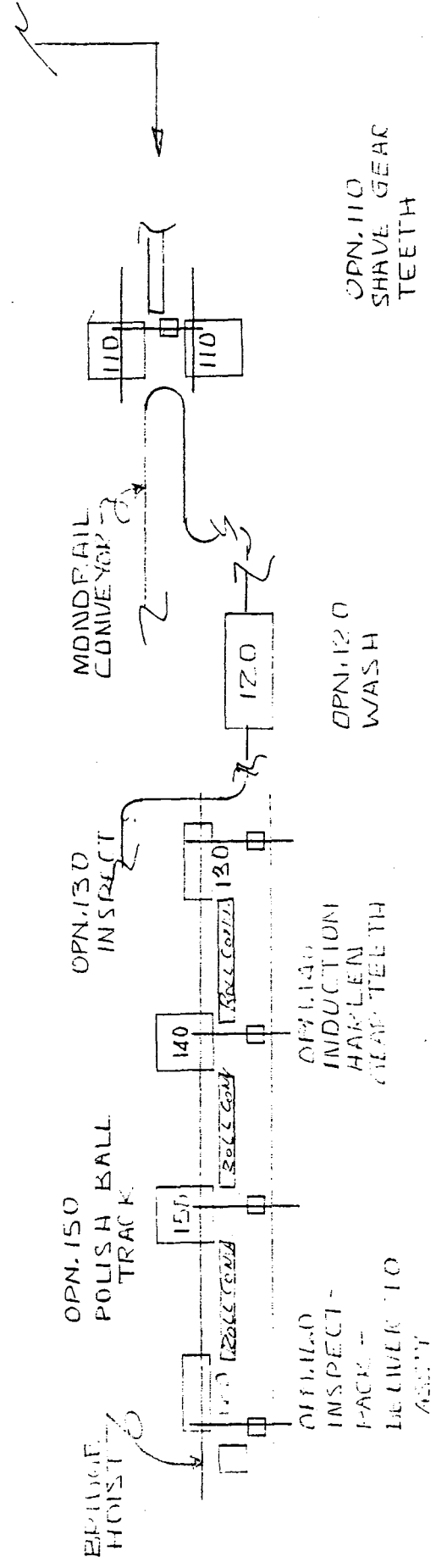
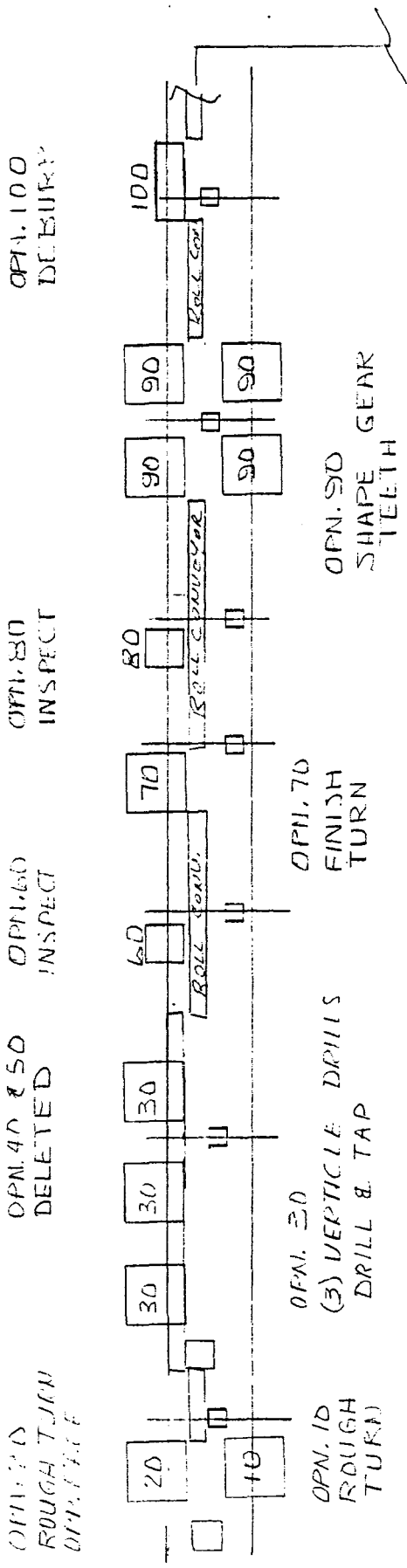
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PRICELESS ESTIMATE SHEET

PROGRAM OR CTR. NO.		PART NAME		ISSUE DATES			DEPARTMENT							
FORD AEROSPACE		OUTPUT RING GEAR (SECONDARY)					PART NO. 936440 16							
PROJECT: HELIOPAT, AZIMUTH DRIVE ASSEMBLY		MATERIAL: PLANT ENGINEERING REQUIREMENTS			WT./LBS.	RGH.	FIN.	RELEASE		SHEET 7 OF 7				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINZ - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. RECD.	NET HOURLY CAP.	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. COST	
1	CHP - COOLANT AND CLARIFICATION SYSTEMS					240,000	180,000	5,000	60,000					
2	COOLANT REFRIGERATION SYSTEM													
3	EXHAUST - FUME - DUST AND VENTILATION													
4	CO FIRE PROTECTION SYSTEM													
5	MONORAIL CONVEYERS					80,000	40,000		40,000					
6	MONORAIL CARRIERS (COOLING)									20,000				
7	POWER CONVEYOR					16,000	10,000	1,000	5,000					
8	POWERED CONVEYERS													
9	PLATFORMS - STAIRS													
10	SERVICE RAILS AND HOISTS					42,000	20,000	2,000	20,000	11,000				
11	TOOL CABINETS - RACKS AND STANDS					8,000	5,000	500	2,500					
12	TOOL CONTROL BOARDS													
13	WORK - GAGING AND INSPECTION TABLES					10,000	5,000		5,000					
14	FIXES BASKETS (EXPENSE)													
15	POSITION AIDS - ASSEMBLY AIDS													
16	SECONDARY LIGHTING													
17	PROGRAMMABLE CONTROLLERS													
18	AUTOMATION - PART HANDLING SYSTEM													
19	ENGINEERING SERVICES DESIGN - (EXPENSE)												10,000	
20	BUILDING SERVICES - UTILITIES													
21	POWER AND FREE CONVEYOR SYSTEM													
22	POWER AND FREE CONVEYOR CARRIERS (TOOLING)													
23	WALKING PLATFORMS AND DECKS													
24	PIPE INSTALLATION (EXPENSE)													
25	MATERIALS HANDLING - RACKS - CONTAINERS - DUMMAGE					30,000	30,000							
	3 Days @ 20x16x3=960													
	30"x60"x8 Highx2 = 16/rack - 960:16=60 racks @\$500													
	6,000 SQ. FT.													
<b>TOTALS:</b>						426,000				31,000			10,000	
TOTALS: FAC. - 2,436														
TOOLIS - 967												\$3,413,000		
EXP. - 10														

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SQUARE FEET = 6000

OUTPUT RING GEAR  
936440

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR EER NO. HELIOSTAT	PART NAME FRICTION RING	ISSUE DATES 9-11-80	PART NO. 926.360
FOR MODELS 50,000 ANN VOL - AZIMUTH DRIVE ASSEMBLY	MATERIAL AISI-1020 STEEL	WT./ LBS. .14	FIN. 14
		RELEASE	SHEET 1 OF 2

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
	MATERIAL: AISI-1020 SHEET STEEL IN SHEETS 36" x 36" x .125 THICKNESS													
10	SHEAR 36" x 36" INTO STRIPS OF 2" x 36" - ONE STRIP = 18 PARTS	8 TON SHEAR PRESS	1	600	.08		EXISTING							
							#2771011-17							
20	TWO STAGE PROGRESSIVE DIE COIN EIGHT OIL GROVES FOUR (4) EACH SIDE AT 45° - BLANK IN DISK SHAPE 1.88 DIA. TRANSFER TO NEXT OPERATION	OBS 200 TON PRESS	1	600	.08		EXISTING			5,520	460	4,600	460	
							#531442-15							
30	HEAT TREAT SPEC. CARBURIZED AND HARDEN PER AW-148-ROCKWELL "C" 58 MIN-TRANSFER TO NEXT OPERATION	SEE H.T. SHEET												
40	GRIND EACH SIDE FOR THICKNESS OF .118 ± .0005 - TRANSPORT TO FINAL ASSEMBLY LINE	TABLE GRINDER 24 x 8 WITH PORT QUICK RELEASE - 38 PARTS	1	380	13	19,480	16,000	480	3,000	5,520	460	4,600	460	
		GAGES								1,500				
	PERSONAL RELIEF				.02									
<b>TOTALS</b>										19,480			12,540	

REMARKS

	PROCESS ENGR. HARD WAY	PLT. LAYOUT INDUSTR. ENGR.	AUTOMATION LAB.	DESIGN QUAL. CONTR.	MATH. MDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME	REQ'D. PER VEHICLE SIX REQMT.	NEXT ASSY: FINAL SUPERSEDES:	OPER. NO.
	Mfg. Development Engrg. & Research	S. LEWIS		OHANESIAN		1.248	78 PC/HR. 16 HRS.		

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**PROCESS ESTIMATE SHEET**

PROGRAM OR ZER NO. HELIOSTAT		PART NAME FRICTION RING			ISSUE DATES 9-12-80		DEPARTMENT PART NO. 926-360								
FOR MODELS AZIMUTH DRIVE ASSEMBLY		MATERIAL PLANT ENGINEERING REQUIREMENTS			WT./ LBS.	RGH.	FIN.	RELEASE	SHEET 2	OF 2					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRAVEL		
1.	CHIP - COOLANT AND CLARIFICATION SYSTEMS					15,200	10,000	200	5,000						
2.	COOLANT REFRIGERATION SYSTEM														
3.	EXHAUST - FUME - DUST AND VENTILATION														
4.	CO <sub>2</sub> FIRE PROTECTION SYSTEM														
5.	MONORAIL CONVEYORS														
6.	MONORAIL CARRIERS (TOOLING)														
7.	ROLLER CONVEYOR														
8.	POWERED CONVEYORS														
9.	PLATFORMS - STILES														
10.	SERVICE RAILS AND HOISTS														
11.	TOOL CABINETS - RACKS AND STANDS														
12.	TOOL CONTROL BOARDS														
13.	WORK - GAGING AND INSPECTION TABLES					1,000	500		500						
14.	PARTS BASKET (EXPENSE)														2,000
15.	PRODUCTION AIDS - ASSEMBLY AIDS														
16.	SECONDARY LIGHTING														
17.	PROGRAMMABLE CONTROLLERS														
18.	AUTOMATION - PART HANDLING SYSTEM														
19.	ENGINEERING SERVICES DESIGN - (EXPENSE)														
20.	BUILDING SERVICES - UTILITIES														
21.	POWER AND FREE CONVEYOR SYSTEM														
22.	POWER AND FREE CONVEYOR CARRIERS (TOOLING)														
23.	MACHINE FOUNDATIONS AND DECKS														
24.	PLANT REARRANGEMENT (EXPENSE)														
25.	MATERIALS HANDLING - RACKS - CONTAINERS - DUNNAGE					2,500	2,000		500						
BUILDING CONSTRUCTION		400 SQ. FT.													
<b>TOTALS</b>						<b>18,700</b>									<b>2,000</b>
REMARKS TOTAL: FAC. - 38,180 TOOLG - 12,540 EXP. - 2,000															
		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR. O'HANESIAN	PRODN.	DAILY PLT. PLANNING VOLUME	REQ'TS. PC/HRS. HRS.	SUPERSEDES:						

Mfg. Development  
Engrg. & Research

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PLANT

D651133-18 DETAIL 31

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR ECR NO. HELIOSTAT		PART NAME JOURNAL PIN			ISSUE DATES 9-18-80				PART NO. A926361 A					
FOR MODELS AZIMUTH DRIVE ASSEMBLY		MATERIAL 8620 STEEL			WT./ LBS.	RGH.	FIN.	RELEASE 2-25-80		SHEET 1 OF 5				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACH. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRAVEL	
5.	RECEIVE BAR STOCK													
10.	LOAD INTO CUTOFF MACHINE - CUTOFF BLANKS TO 4.412 LENGTH .40 MIN/PC	ABRASIVE CUTOFF MACHINE	1	96	.50	AVAILABLE FROM DIT 8 ELEVATOR DRIVE ASSEMBLY								
20.	GRIND OD TO PRE-HEAT TREATMENT SIZE TO ASSURE CORRECT SURFACE HARDNESS .15 MIN/PC	CENTERLESS CRINDER FEEDER	1	256	.19	AVAILABLE D651133-18 DETAIL				3,000				
TOTALS										3,000				
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR. J. CHILTON	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE 150,000	REQ'D. PER VEHICLE THREE	NEXT ASSY:	OPER. NO.				
		INDUSTR. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME 625	REQ'TS. 39 PC/HR. 16 HRS.	SUPERSEDES:					

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PLANT

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PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR CEN NO. HELIOSTAT		PART NAME JOURNAL PIN			ISSUE DATES 9-11-80			PART NO. A 926361-A									
FOR MODELS AZIMUTH DRIVE ASSEMBLY		MATERIAL 8620 STEEL			WT./ LBS.	RGH. .41	FIN.	RELEASE 2-25-80	SHEET 2 OF 5								
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REVD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST				
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD		INST. TRVOLT			
30	CHUCK ON O.D. - STOP ON END OF PIN PLUNGE CHAMFER, TURN AROUND .50 MIN/PC	SPEED LATHE (REF. - HARDINGE) DV59	1	76	63	9,200	8,000	200	1,000	2,000							
40	HEAT TREATMENT  INDUCTION HARDNER AVAILABLE IF TREATMENT IS REQUIRED.																
TOTALS																	
REMARKS																	
PROCESS ENGR. J. CALHOUN		PLT. LAYOUT LAB.		AUTOMATION QUAL. CONTR.		DESIGN PLT. ENGR. DIANESIAN		MATH. MDLG. ENGR.		DAILY SERVICE 150,000 PER YR. DAILY PLT. PLANNING VOLUME 625		REQ'D. PER VEHICLE THREE REQMTS. 39 PC/HR. 16 HRS.		NEXT ASSY: SUPERSEDES:		OPER. NO.	

Mfg. Development  
Engrg. & Research

PLANT \_\_\_\_\_

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PROCESS ESTIMATE SHEET

DEPARTMENT: \_\_\_\_\_

PROGRAM OR CERN NO HELIOSTAT	PART NAME JOURNAL PIN	ISSUE DATES 9-11-80	PART NO. A-926361-A
FOR MODELS AZIMUTH DRIVE ASSEMBLY	MATERIAL 8620 STEEL	WT./ LBS.    RGH.    FIN. .41	RELEASE    SHEET OF 2-25-80    3    5

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S RECD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. BY COST		
50	FINISH GRIND TO .5898 DIAMETER .10 MIN	CENTERLESS GRINDER		384	.13	AVAILABLE	D651133-18 DETAIL 9				1,000				
60	POLISH CONTACT AREA TO 16 MICRO .50 MIN/PC	PAPER POLISHER	1	76	.63	AVAILABLE	D-651133-18 DETAIL 5								
<b>TOTALS</b>										1,000					

REMARKS \_\_\_\_\_

	PROCESS ENGR. J. CALHOON	PLT. LAYOUT LAB.	AUTOMATION	DESIGN PLT. ENGR.	MATH. MDLG. ENGR. PRODN.	DAILY SERVICE 150,000 DAILY PLT. PLANNING VOLUME 625	REQ'D. PER VEHICLE THREE RECYCLE 39 PC/HR. 16 HRS.	NEXT ASSY: SUPERSEDES:	OPER. NO.
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*Stone* Mfg. Development  
Engrg. & Research

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PLANT

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PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR ECR NO.		PART NAME			ISSUE DATES			PART NO.						
HELIOSTAT FOR MODELS AZIMUTH DRIVE ASSEMBLY		JOURNAL PIN			9-11-80			A-926361-A						
		MATERIAL			WT./	RGH.	FIN.	RELEASE		SHEET		OF		
		8620 STEEL			LBS.	.41		2-25-80		4		5		
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRYS	
70	DEMAGNETIZE	DEMAG COIL	1		INC. IN CYCLE	2,200	2,000		200					
80	WASH	INDUSTRIAL WASHER			INC. IN CYCLE	AVAILABLE								
90	INSPECTION	GAGES			IND. LAB					5,000				
	PERSONAL RELIEF				14									
TOTALS						2.22	2,200			5,000				
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR. J. CALHOUN	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE 150,000	REQ'D. PER VEHICLE THREE	NEXT ASSY:	OPER. NO.				
		INDUSYR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODH.	DAILY PLT. PLANNING VOLUME 625	REQMTS. 39PC/NR. 16 HRS.	SUPERSEDES:					

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PROCESS ESTIMATE SHEET

PROGRAM OR CCR NO.		PART NAME			ISSUE DATES			DEPARTMENT								
HELIOSTAT		JOURNAL PIN			9-12-80			A-926361-A								
FOR MODELS		MATERIAL			WT./	RGH.	FIN.	RELEASE		SHEET 5 OF 5						
AZIMUTH DRIVE ASSEMBLY		PLANT ENGINEERING REQUIREMENTS			LBS.											
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR D.T. NUMBER	MACH'S REQB.	NET HOURLY CAP.	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST		
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. BYG.			
1.	CHIP - COOLANT AND CLARIFICATION SYSTEMS															
2.	COOLANT REFRIGERATION SYSTEM															
3.	EXHAUST - FUME - DUST AND VENTILATION															
4.	CO <sub>2</sub> FIRE PROTECTION SYSTEM															
5.	MONORAIL CONVEYORS															
6.	MONORAIL CARRIERS (TOOLING)															
7.	ROLLER CONVEYOR															
8.	POWERED CONVEYORS															
9.	PLATFORMS - STILES															
10.	SERVICE RAILS AND HOISTS															
11.	TOOL CABINETS - RACKS AND STANDS					500	250		250							
12.	TOOL CONTROL BOARDS															
13.	WORK - GAGING AND INSPECTION TABLES					500	250		250							
14.	PARTS BASKETS (EXPENSE)														3,000	
15.	PRODUCTION AIDS - ASSEMBLY AIDS															
16.	SECONDARY LIGHTING															
17.	PROGRAMMABLE CONTROLLERS															
18.	AUTOMATION - PART HANDLING SYSTEM															
19.	ENGINEERING SERVICES DESIGN (EXPENSE)															
20.	BUILDING SERVICES - UTILITIES															
21.	POWER AND FREE CONVEYOR SYSTEM															
22.	POWER AND FREE CONVEYOR CARRIERS (TOOLING)															
23.	MACHINE FOUNDATIONS AND DECKS															
24.	PLANT REARRANGEMENT (EXPENSE)															
25.	MATERIALS HANDLING - RACKS - CONTAINERS - DUNNAGE					2,500	2,000		500							
BUILDING CONSTRUCTION						400 SQ. FT.										
TOTALS						3,500										3,000
REMARKS																
TOTALS: FAC - 14,800 TOOLG - 11,000 } = 28,800 EXP. - 3,000																
		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.						
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:							
Mfg. Development Engg. & Research																

PLANT

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PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR CTR NO. HELIOSTAT FOR MODELS AZIMUTH DRIVE ASSEMBLY		PART NAME BALL RETAINING BOLT			ISSUE DATES 9-11-80			PART NO. A 926913							
		MATERIAL STEEL STD. 3/4-16 CAPSCR MOD.			WT./ LBS.	RGH.	FIN.	RELEASE 3-17-80	SHEET 1 OF 2						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTAL-LATION	TOTAL	DESIGN	BUILD	INST. TRYS		
5	RECEIVE PURCHASED 3/4"-16 x 1.25LG HEX HD CAP SCREWS.  MODIFY AS FOLLOWS;														
10	CUT OFF TO LENGTH, FACE INSIDE OF HEX HD AND UNDERCUT THREAD  .65 MIN/PC	HARDING SPEED LATHE	1	59	.81	AVAILABLE FROM 926361 - DET. 31				2000					
20	INSPECTION  PERSONAL RELIEF	GAGES			IND. LAB					1000					
					.86					3000					
REMARKS															
		PROCESS ENGR. J. Calhoun	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR. Dhanesian	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME 208	REQ'D. PER VEHICLE one REQMTS. 13 PC/HR. 16 HRS.	NEXT ASSY: SUPERSEDES:				OPER. NO.		

Std. Mfg. Development  
Engg. & Research

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PLANT

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PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR ECR NO.		PART NAME				ISSUE DATES		PART NO.							
HELIOSTAT		BALL RETAINING BOLT				9-11-80		A-926913							
FOR MODELS		MATERIAL			WT./	RGH.	FIN.	RELEASE		SHEET OF					
AZIMUTH DRIVE ASSEMBLY		PLANT ENGINEERING REQUIREMENTS			LBS.					2 OF 2					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQ.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRNG.		
1.	CHIP - COOLANT AND CLARIFICATION SYSTEMS					2000	1500		500						
2.	COOLANT REFRIGERATION SYSTEM														
3.	EXHAUST - FUME - DUST AND VENTILATION														
4.	CO <sub>2</sub> FIRE PROTECTION SYSTEM														
5.	MONORAIL CONVEYORS														
6.	MONORAIL CARRIERS (TOOLING)														
7.	ROLLER CONVEYOR														
8.	POWERED CONVEYORS														
9.	PLATFORMS - STILES														
10.	SERVICE RAILS AND HOLSTS														
11.	TOOL CABINETS - RACKS AND STANDS														
12.	TOOL CONTROL BOARDS														
13.	WORK - GAGING AND INSPECTION TABLES														
14.	PARTS BASKETS (EXPENSE)	10 @													500
15.	PRODUCTION AIDS - ASSEMBLY AIDS														
16.	SECONDARY LIGHTING														
17.	PROGRAMMABLE CONTROLS														
18.	AUTOMATION - PART HANDLING SYSTEM														
19.	ENGINEERING SERVICES DESIGN (EXPENSE)														
20.	BUILDING SERVICES - UTILITIES														
21.	POWER AND FREE CONVEYOR SYSTEM														
22.	POWER AND FREE CONVEYOR CARRIERS (TOOLING)														
23.	MACHINE FOUNDATIONS AND DECKS														
24.	PLANT REARRANGEMENT (EXPENSE)														
25.	MATERIALS HANDLING @ RACKS @ CONTAINERS - DUNNAGE					2500	2000		500						
BUILDING CONSTRUCTION		300 SQ. FT.													
TOTALS						4500									500
REMARKS TOTALS: FAC. - 13,700 TOOLS - 3,000 } = 17,200 EXP. - 500															
Mfg. Development Engrg. & Research		PROG. ENGR.	PLY. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
		INDUST. ENGR.	LAB.	QUAL. CONTR.	PLY. ENGR.	PRODN.	DAILY PLY. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:						

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PROCESS ESTIMATE SHEET

PROGRAM OR CTR NO. HELICOPTER		PART NAME GIMBAT, HOUSING			ISSUE DATES 5-1-80		DEPARTMENT PART NO. 531146							
FOR MODELS		MATERIAL NODULAR IRON			WT./ LBS.	RGH. 60 LB.	FIN.	RELEASE	SHEET 1 OF 6					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTAL- LATION	TOTAL	DESIGN	BUILD	INST. VEHICLE	
5	REG. INSPECTION				IND. LAB.									
	CHECK FOR SUFFICIENT MACHINING STOCK	GAGES	N			500			500	500				
	SOFTNESS OF CASTING, EXCESSIVE METAL FLASH, AND QUALITY OF CASTING													
	CHECK DIMENSIONALLY EVERY THOUSANTH CASTING, 100% TO CASTING BLUE PRINT.													
	MANUAL LOAD AND UNLOAD ON/PO ROLLER CONVEYOR	ROLLER CONVEYOR SYSTEM THROUGH OUT ALL PERATIONS				P. E.								
TOTALS						500			500					
REMARKS														
Mfg. Development Eng. & Research		PROCESS ENGR. P. BOES	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PROGN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME 208	REQ'D. PER VEHICLE REQMTS. 16 PC/HR. 16 HRS.	NEXT ASSY: SUPERSEDES:	OPER. NO. 5				

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PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO.		PART NAME				ISSUE DATES			DEPARTMENT					
		CIMBAL HOUSING							PART NO. 531146					
FOR MODELS		MATERIAL		WT./LBS.	RGH.	FIN.	RELEASE		SHEET 2 OF 6					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRNG. CAT	
10	ROUGH AND FINISH TURN BOTTOM "A" .005 FLATNESS	N.B. MOD. #66 VERT. TURNING MACHINE	1-N	26	1.85	181,000	165,000		3,000	20,000				
	MANUALLY LOAD & UNLOAD													
20	DRILL (10) BOFF HOLES SUB-LAND DRILL (2) BOFF HOLES FOR LOC. HOLES.	NATCO 24 SPINDLE MULTIPLE DRILLING MACH. SHIPPIE TABLE (2) POSITIONS	1-N	40	1.20	82,000	75,000		2,000	40,000				
	STOPFACE (10) BOFF HOLES.													
	MANUALLY LOAD AND UNLOAD				THC. IN MACH. CYC.									
TOTALS						263,000				60,000				
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY.	OPER. NO.				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMYS. PC/HRS. HRS.	SUPERSEDES.					

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**PROCESS ESTIMATE SHEET**

PLANT		PROGRAM OR ECR NO.					PART NAME			ISSUE DATES			DEPARTMENT					
FOR MODELS		GIMBAL HOUSING					MATERIAL			WT./ LBS.    RGH.    FIN.			PART NO. 531146		RELEASE		SHEET 3 OF 6	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST				
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. BY CAT					
30	POSITION #1	HY-POWERMATIC																
	GANG MILL (4)	CINCINNATI-HORIZONTAL MILLING MACHINE	1N	24	2.00	144,000	131,000	2,000	11,000	25,000								
	"B" HOLE AREA SIDE SURFACES	MOD. 315-266, 30 H.P.																
	POSITION #2																	
	GANG MILL (4) "C" HOLE AREA SIDE SURFACES																	
		GAGES	N			2,000			2,000	13,000								
	MANUAL LOAD AND UNLOAD																	
					INC. IN MACH CYC													
<b>TOTALS</b>						146,000				38,000								
<b>REMARKS</b>																		
		PROCESS ENGR. P. BOES	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.								
		INDUSTY. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR.    HRS.	SUPERSEDES:	30								

*Ford* Mfg. Development  
Engrg. & Research

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PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO.		PART NAME				ISSUE DATES				DEPARTMENT				
FORM MODELS		GIMBAL HOUSING								PART NO. 531146				
		MATERIAL		WT./LBS.	RGH.	FIN.		RELEASE		SHEET 4 OF 6				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S RECD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. (BY CAT)	
50	DRILL (4) SHAFT HOLES	D.E. ORTZ, DRILLING MACH. 2 SPD. L&R	IN	30	1.6	99,000	90,000	2,000	7,000	15,000				
	MANUAL LOAD AND UNLOAD													
50	ROUGH AND FINISH BORE (2) 1.2505 DIAS AND (2) 1.0010 DIAS	D.E. BORING 3 SPINDLE MACHINE	IN	75	.64	198,000	180,000	3,000	15,000	70,000				
		GAGES	N			3,000			3,000	16,000				
	MANUAL LOAD AND UNLOAD				INC. IN MACH. CYC									
TOTALS						300,000				101,000				
REMARKS														
Mfg. Development Eng. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:		OPER. NO.	
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME		REQMTS. PC/HR. HRS.		SUPERSEDES:		40 50	

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**PROCESS ESTIMATE SHEET**

PROGRAM OR ECR NO.		PART NAME GIMBAL HOUSING				ISSUE DATES			DEPARTMENT					
FOR MODELS		MATERIAL		WT./LBS.	RGH.	FIN.	PART NO. 531146		RELEASE	SHEET 5 OF 6				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. BYC/23	
60	WASH - RINSE AND DRY	1 STAGE WASHER ALSO USED FOR ALL MAJOR CASTINGS	A	250	0.20	AVAILABLE								
	MANUAL LOAD AND UNLOAD				INC.									
70	VISUALLY INSPECT FOR COMPLETION OF ALL MACHINING AND POSSIBLE DISCREPANCY	ROLLER CONVEYOR SYSTEM			MACH. CYC									
R-75	REPAIR AREA 2% OF PRODUCTION	GENERAL REPAIR AREA			(INC. IN 80% W.S.)	29,000	25,000	1,000	3,000	5,000				
80	PLACE IN PROTECTIVE CONTAINER AND SHIP TO ASSEMBLY				0.25									
	PERSONAL RELIEF				0.52									
<b>TOTALS</b>					8.26	29,000				5,000				
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR. P. BOES	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODM.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR.	MRS.	SUPERSEDES:		60-70 R75-80		

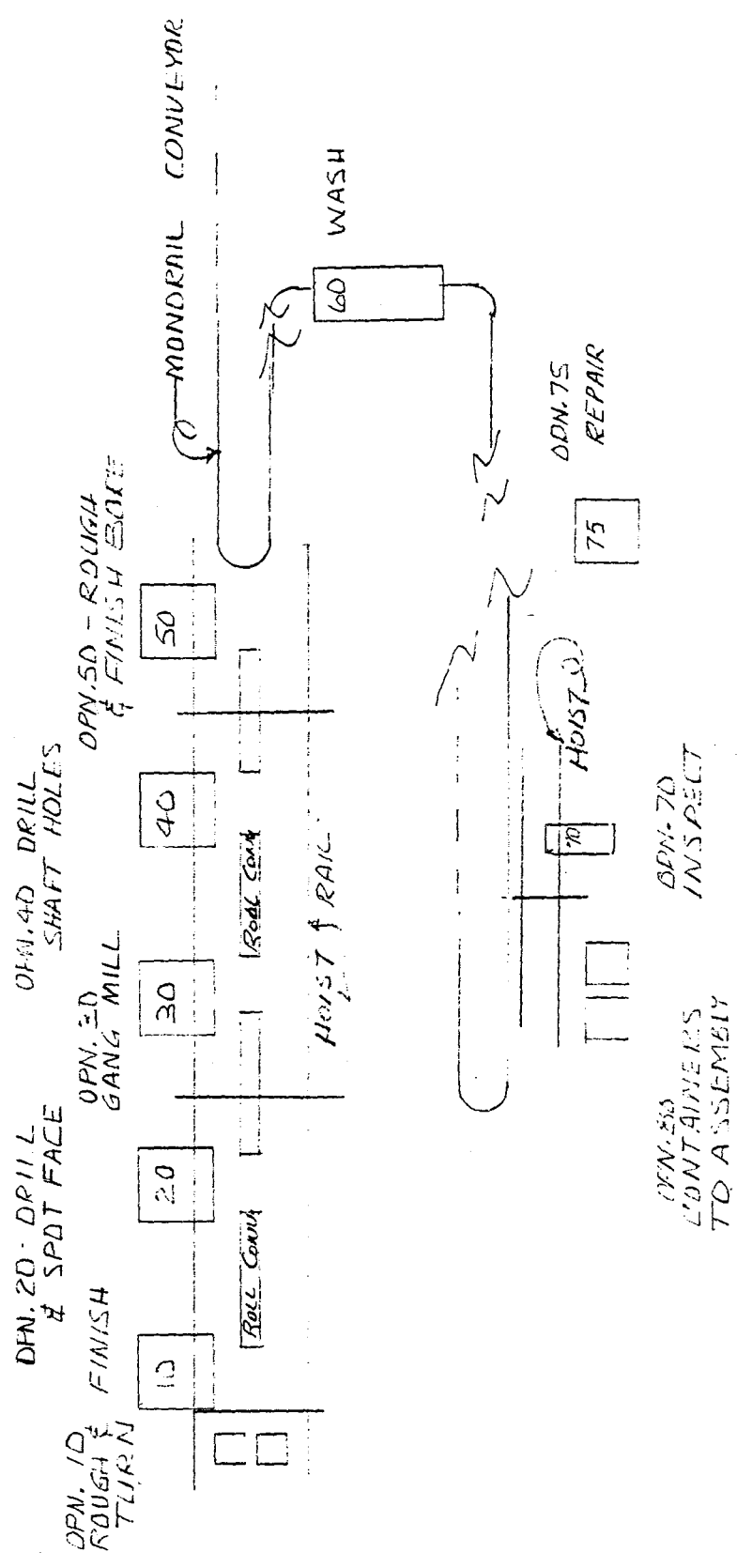
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PROCESS ESTIMATE SHEET

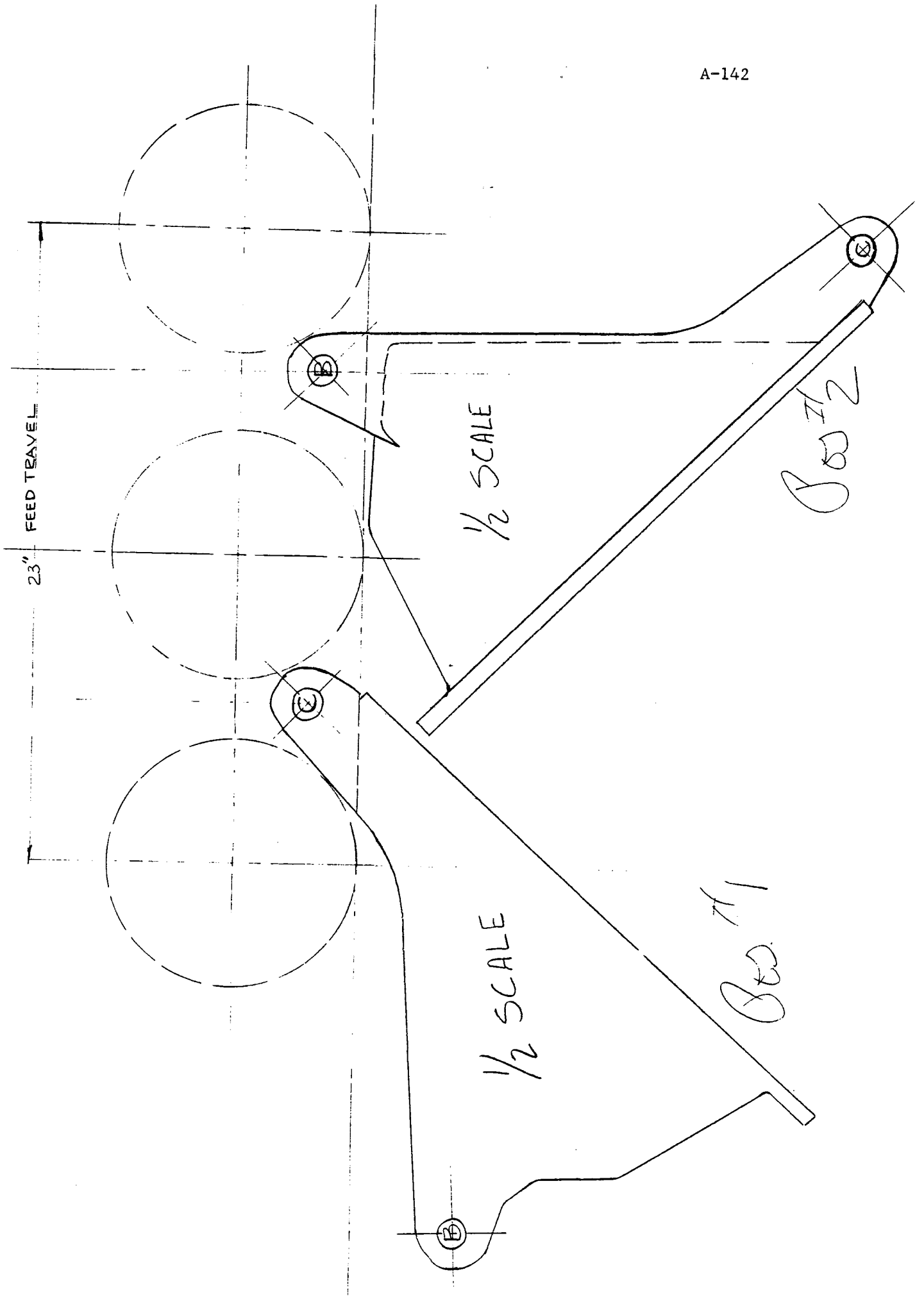
PLANT		PART NAME				ISSUE DATES				DEPARTMENT				
PROGRAM OR EEM NO. FORD AEROSPACE		GIMABL HOUSING								PART NO. 531146				
FOR MODEL HELIOSTAT		MATERIAL PLANT ENGINEERING REQUIREMENTS				WT./ LBS.	RGH.	FIN.	RELEASE				SHEET 6 OF 6	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH' REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYS.	
1.	CHIP - COOLANT AND CLARIFICATION SYSTEMS					103,000	75,000	3,000	25,000					
2.	COOLANT REFRIGERATION SYSTEM													
3.	EXHAUST - FUME - DUST AND VENTILATION													
4.	CO <sub>2</sub> FIRE PROTECTION SYSTEM													
5.	MONORAIL CONVEYORS					40,000	20,000		20,000					
6.	MONORAIL CARRIERS (TOOLING)									10,000				
7.	ROLLER CONVEYOR					9,000	6,000		3,000					
8.	POWERED CONVEYOR													
9.	PLATFORMS - STILES													
10.	SERVICE RAILS AND HOISTS					16,000	8,000		8,000	6,000				
11.	TOOL CABINETS - RACKS AND STANDS					5,000	4,000		1,000					
12.	TOOL CONTROL BOARDS													
13.	WORK - GAGING AND INSPECTION TABLES					8,000	5,000		3,000					
14.	PARTS BASKETS (EXPENSE)													
15.	PRODUCTION AIDS - ASSEMBLY AIDS					7,000	5,000		2,000					
16.	SECONDARY LIGHTING					1,000	500		500					
17.	PROGRAMMABLE CONTROLLERS													
18.	AUTOMATION - PART HANDLING SYSTEM													
19.	ENGINEERING SERVICES DESIGN (EXPENSE)													10,000
20.	BUILDING SERVICES - UTILITIES													
21.	POWER AND FREE CONVEYOR SYSTEM													
22.	POWER AND FREE CONVEYOR CARRIERS (TOOLING)													
23.	MACHINE FOUNDATIONS AND DECKS													
24.	PLANT REARRANGEMENT (EXPENSE)													
25.	MATERIALS HANDLING - RACKS - CONTAINERS - DUNNAGE													
	BUILDING CONSTRUCTION	4000 SQ. FT.												
TOTALS						189,000				16,000				10,000
REMARKS TOTALS: F. - 927.5 T. - 220.5 } = 1,158,000 E. - 10.0														
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:		OPER. NO.	
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME		REQMTS. PC/HRS. HRS.		SUPERSEDES:			

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GIMBAL HOUSING  
531146

SQ. FT. 4000



PROCESS ESTIMATE SHEETS  
ELEVATION DRIVE ASSEMBLY

<u>Shop Assembly</u>	#D-651140-18/531436	A-145
Sheet 1	Assemble Bearing Cup and Shaft Seal to Shaft Cover	
Sheet 2	Assemble Bearing Cup and Pivot Pin Bushing to Elevation Drive Housing	
Sheet 3	Grease Bearings	
Sheets 4-5	Assemble Bearings and Gear to Elevation Drive Shaft	
Sheet 6	Assemble Seal Enclosure Cap to Elevation Drive Shaft	
Sheet 7	Assemble Shaft to Elevation Drive Housing	
Sheet 8	Assemble Worm Gear to Elevation Shaft Housing	
Sheet 9	Assemble Bearing Cup to Attach. Housing	
Sheet 10	Assemble Worm Housing to Elevation Shaft Housing	
Sheet 11	Assemble Gear to Elevation Worm	
Sheet 12	Assemble Seal to Attach. Housing Cap	
Sheet 13	Assemble Worm to Attach. Housing	
Sheet 14	Assemble Seal to Motor Adapter	
Sheet 15	Assemble Cover to Attach. Housing	
Sheet 16	Assemble Motor Adapter to Attach. Housing	
Sheet 17	Assemble Coupling to Elevation Motor	
Sheet 18	Assemble Motor to Motor Adapter	
Sheet 19	Assemble Pipe Plugs and Alemite Fittings	
Sheet 20	Lubricate Elevation Drive	
Sheet 21	Sub-assemble Magnet Holder to Rev. Counter Adapter	
Sheet 22	Sub-assemble Rev. Counter Adapter to Sleeve	
Sheet 23	Assemble Magnet Holder to Worm Shaft	
Sheet 24	Assemble Rev. Counter Adapter/Sleeve to Elevation Drive	
Sheet 25	Adjust Gap between Magnet and IC's	
Sheet 26	Assemble Cover to Motor Rev. Counter	
Sheet 27	Assemble Stop Collars and Actuator Nut to Elevation Shaft	
Sheet 28	Facility and Tooling Cost Summary	
Sheet 29	Direct Labor Stds. Recap	
Sequence Sketch		
<u>Item 1 Housing</u>	#D-651140-22	A-175
Sheets 1-3	Housing - Elevation	
Sheet 4	Plant Engineering Requirements	
Sequence Sketch		
<u>Item 2 Attachment Housing</u>	#C-651140-46	A-180
Sheets 1-3	Attachment Housing	
Sheet 4	Plant Engineering Requirements	
Sequence Sketch		
<u>Item 3 Attachment Housing Cover</u>	#A-5510	A-185
Sheet 1	Attachment Housing Cover	
Sheet 2	Plant Engineering Requirements	
Sequence Sketch		

<u>Item 4</u>	<u>High Speed Cap-Closed</u>	#A-4485	A-188
	Sheets 1-2	High Speed Cap-Closed	
	Sheet 3	Plant Engineering Requirements	
	Sequence Sketch		
<u>Item 5</u>	<u>S.S. Cover</u>	#B-651140-20	A-192
	Sheets 1-2	S.S. Cover	
	Sheet 3	Plant Engineering Requirements	
	Sequence Sketch	and Detail Sketch	
<u>Item 6</u>	<u>High Speed Cap-Open</u>	#A-651140-45	A-197
	Sheets 1-3	High Speed Cap-Open	
	Sheet 4	Plant Engineering Requirements	
	Sequence Sketch		
<u>Item 7</u>	<u>Standard Motor Adapter</u>	#C-7922	A-202
	Sheets 1-2	Standard Motor Adapter	
	Sheet 3	Plant Engineering Requirements	
	Sequence Sketch		
<u>Item 8</u>	<u>S.S. Shaft</u>	#B-651140-23	A-206
	Sheets 1-5	S.S. Shaft	
	Sheet 6	Plant Engineering Requirements	
	Sequence Sketch		
<u>Item 9</u>	<u>Slow Shaft Spacer</u>	#A-651140-21	A-213
	Sheets 1-3	S.S. Spacer	
	Sheet 4	Plant Engineering Requirements	
	Sequence Sketch		
<u>Item 10</u>	<u>S.S. Shaft Washer</u>	#A-651140-44	A-218
	Sheet 1	S.S. Shaft Washer	
	Sheet 2	Plant Engineering Requirements	
	Sequence Sketch		
<u>Item 27</u>	<u>Upper Stop Collar</u>	#A-651140-43	A-221
	Sheet 1	Upper Stop Collar	
	Sheet 2	Plant Engineering Requirements	
	Sequence Sketch		
<u>Item 28</u>	<u>Lower Stop Collar</u>	#A-651140-48	A-224
	Sheets 1-4	Lower Stop Collar	
	Sheet 5	Plant Engineering Requirements	
	Sequence Sketch		

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PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

PROGRAM OR ECA NO.		PART NAME ASSEMBLE BEARING CUP & SHAFT SEAL TO SHAFT COVER				ISSUE DATES 9-11-80		DEPARTMENT				PART NO. D-651140-18A		
FOR MODELS ELEVATION DRIVE ASSEMBLY		MATERIAL			WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 1 OF 1				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTAL-LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
	PARTS REQUIRED: (1) DETAIL #5 COVER (1) DETAIL #14 TIMKEN CUP (1) DETAIL #24 SEAL													
10	OBTAIN DETAIL #5 COVER FROM STOCK & POSITION IN PRESSES	ARBOR PRESS			.20									
20	OBTAIN DETAIL #14 CUP FROM STOCK & POSITION TO COVER, PRESS IN PLACE				.30									
30	TURN COVER OVER, OBTAIN DETAIL #24 SEAL FROM STOCK AND POSITION TO COVER, PRESS IN PLACE				.35									
40	TRANSFER COVER ASSEMBLY TO SHAFT ASSEMBLY OPERATION				.10									
TOTALS					.95									
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR. L. PALMER	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR. OHANESTAN	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME	REQ'D. PER VEHICLE REDMTS. PC/NR.	HRS.	NEXT ASSY: SUPERSEDES:	OPER. NO. 10			

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22A

PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR ECR NO		PART NAME ASSEMBLE BEARING CUP & PIVOT PIN BUSHING TO ELEVATOR DRIVE HOUSING				ISSUE DATES 9-11-80		PART NO. D-651140-18A							
FORM MODELS ELEVATOR DRIVE ASSEMBLY		MATERIAL		WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 1 OF 1						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'Y RECD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INIT. TRYOUT		
	PARTS REQUIRED:														
	(1) DETAIL #1 HOUSING														
	(1) DETAIL #12 TIMKEN CUP														
	(1) DETAIL #42, DRAWING #531436 BUSHING														
	(1) DETAIL #16 TIMKEN CUP														
10	OBTAIN DETAIL #1 HOUSING FROM STOCK AND POSITION IN PRESS	ARBOR PRESS			.20										
20	OBTAIN DETAIL #12 CUP FROM STOCK & POSITION IN HOUSING, PRESS IN PLACE				.30										
30	REPOSITION HOUSING, OBTAIN DETAIL #42 BUSHING FROM STOCK AND POSITION TO HOUSING, PRESS IN PLACE				.35										
40	REPOSITION HOUSING, OBTAIN DETAIL #16 CUP & POSITION TO HOUSING, PRESS IN PLACE				.35										
50	TRANSFER HOUSING TO NEXT OPERATION				.10										
TOTALS					1.30										
REMARKS															
Mfg. Development Engng. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO.				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR.	HRS.	SUPERSEDES:					
		I. PALMER									20				
		S. Lewis													

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22A

PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR ECR NO.		PART NAME GREASE BEARINGS				ISSUE DATES 9-11-80		PART NO. D-651140-18A							
FOR MODELS ELEVATION DRIVE ASSEMBLY		MATERIAL		WT./LBS.	RGH.	FIN.	RELEASE		SHEET 1 OF 1						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
	PARTS REQUIRED: (1) DETAIL #11 CONE (1) DETAIL #13 CONE (2) DETAIL #15 CONE (2) DETAIL #17 CONE														
0	PICK UP CONE AND POSITION ON WHEEL BEARING PACKER, ACTUATE HANDLE MANUALLY UNFIT BEARING IS FULL OF GREASE	WHEEL BEARING PACKER			.30										
0	REMOVE BEARING & TRANSFER TO ASSEMBLY OPERATION				.10										
TOTALS					.40										
REMARKS REPEAT OPERATION FOR (5) MORE BEARING															
Mfg. Development Engg. & Research		PROCESS ENGR. I. PALMER	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MOLD. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME	REQ'D. PER VEHICLE REQMTS. PC/HR.	MENT ASSY: SUPERSEDES. HRS.	OPER. NO. 30					

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22A

PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR ECR NO.		PART NAME				ISSUE DATES				PART NO.					
FOR MODELS		MATERIAL				WT./	RGH.	FIN.	9-11-80				RELEASE	SHEET 1 OF 2	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRYGTS		
	PARTS REQUIRED:														
	(1) COVER FROM OPER. 10														
	(1) DETAIL #13 TIMKEN CONE (FROM OPER. 30)														
	(1) DETAIL #31 GEAR KEY														
	(1) DETAIL #53 GEAR														
	(1) DETAIL # 9 SPACER														
	(1) DETAIL #11 TIMKEN CONE (FROM OPER. 30)														
	(1) DETAIL #10 SHAFT WASHER														
	(1) DETAIL #46 NYLOCK BOLT														
	(1) DETAIL # 8 SHAFT														
10	OBTAIN DETAIL #8 SHAFT FROM STOCK & PLACE IN FIXTURE, CLOSE CLAMP	SUB-ASSEMBLY FIXTURE			.25										
20	OBTAIN COVER ASSEMBLY & DETAIL #13 CONE FROM STOCK AND POSITION ON SHAFT	MANUAL			.20										
30	OBTAIN DETAIL #31 GEAR KEY & POSITION IN SLOT ON SHAFT	MANUAL			.20										
40	OBTAIN DETAIL #53 GEAR AND POSITION ON SHAFT OVER KEY	MANUAL			.20										
50	OBTAIN DETAIL #9 SPACER AND POSITION ON SHAFT	MANUAL			.20										
TOTALS															
REMARKS															
Mfg. Development		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MOLDG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
Engrg. & Research		L. PALMER	INDUSTY. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQ'TS. PC/HR.	HR.	SUPERSEDES:		40		
		S. LEWIS													

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22A

PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO.		PART NAME				ISSUE DATES		DEPARTMENT							
FOR MODELS ELEVATION DRIVE ASSEMBLY		ASSEMBLE BEARING & GEAR TO ELEV. DRIVE SHAFT				9-11-80		PART NO. D-651140-18A							
		MATERIAL				WT./	RGH.	FIN.	RELEASE	SHEET 2 OF 2					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. BY/CAT		
60	OBTAIN DETAIL #11 CONE, DETAIL #10 SPACER & DETAIL #46 BOLT FROM STOCK, POSITION CONE & SPACER TO SHAFT & LOOSE ASSEMBLE BOLT	MANUAL			.35										
70	SECURE BOLT WITH POWER TOOL	PNEUMATIC RT. ANGLE TOOL			.10										
80	RELEASE CLAMP & REPOSITION SHAFT FOR ASSEMBLY OF SEAL ENCLOSURE CAP				.15										
TOTALS					1.65										
REMARKS															
Mfg. Development Engr. & Research		PROCESS ENGR. L. PALMER	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
		INDUSTR. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:	40					

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR ECR NO.	PART NAME ASSEMBLE SEAL ENCLOSURE CAP TO ELEV. DRIVE SHAFT	ISSUE DATES 9-11-80	PART NO. D-651140-18A
FOR MODELS ELEVATION DRIVE ASSEMBLY	MATERIAL	WT./ LBS.	RELEASE
		RGH. FM.	SHEET 1 OF 1

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
	PARTS REQUIRED: (1) DETAIL #25 SEAL ENCLOSURE CAP (1) DETAIL #26 WORM DRIVE POWER CLAMP													
10	OBTAIN DETAIL #25 SEAL ENCLOSURE CAP & DETAIL # 26 CLAMP FROM STOCK				.20									
20	POSITION ENCLOSURE CAP ON DRIVE SHAFT OVER COVER	MANUAL			.15									
30	POSITION CLAMP OVER ENCLOSURE CAP AND SNUG UP WITH SCREWDRIVER	HAND SCREWDRIVER			.45									
40	TRANSFER ASSEMBLY TO NEXT OPERATION				.10									
TOTALS					90									

REMARKS

	PROCESS ENGR. I. PALMER	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATH. MDLG. ENGR. PRODM.	DAILY SERVICE DAILY PLT. PLANNING VOLUME	REQ'D. PER VEHICLE PC/HR. MRS.	NEXT ASSY: SUPERSEDES.	OPER. NO. 50
Mfg. Development Engrg. & Research									

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR CCR NO.		PART NAME ASSEMBLE SHAFT TO ELEV. DRIVE HOUSING				ISSUE DATES 9-11-80		PART NO. D-651140-18A							
FOR MODELS ELEVATION DRIVE ASSEMBLY		MATERIAL		WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 1 OF 1						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TOYQZT		
	PARTS REQUIRED: (1) SHAFT ASSEMBLY (FROM OPER. 50) (1) HOUSING ASSEMBLY (FROM OPER. 20) (6) DETAIL #45 BOLT (6) DETAIL #49 LOCKWASHER (1) DETAIL #19 GASKET														
10	PICK UP HOUSING & POSITION IN FIXTURE, CLOSE CLAMP	ELEVATOR DRIVE ASSEMBLY FIXTURE			.25										
20	PICK UP DETAIL #19 GASKET & POSITION TO HOUSING	MANUAL			.20										
30	PICK UP SHAFT ASSEMBLY AND POSITION TO HOUSING LOOSE ASSEMBLE (6) BOLTS & WASHERS	MANUAL			.65										
40	SECURE BOLTS WITH POWER TOOL	PNEUMATIC RT. ANGLE NUTRUNNER			.30										
TOTALS					1.40										

REMARKS

Mfg. Development Engrg. & Research	PROCESS ENGR. L. PALMRR	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO. 60
	INDUSTY. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMIS. PC/NR. HRL.	SUPERSEDES:	

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR OPER NO.		PART NAME ASSEMBLE WORM GEAR TO ELEV. SHAFT HOUSING				ISSUE DATES 9-11-80		PART NO. D-651140-18A						
FOR MODELS ELEVATION DRIVE ASSEMBLY		MATERIAL		WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 1 OF 1					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR D.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. BY CAT	
	PARTS REQUIRED:													
	(2) DETAIL #15 TIMKEN CONE (FROM OPER. 30)													
	(1) DETAIL #52 WORM													
	(1) DETAIL #16 TIMKEN CUP													
	(1) DETAIL #20 GASKET													
	(1) DETAIL #4 COVER													
	(4) DETAIL #41 BOLT													
	(4) DETAIL #48 LOCKWASHER													
10	OBTAIN (2) DETAIL #15 CONE AND (1) DETAIL #52 WORM AND POSITION IN HOUSING	ELEVATOR DRIVE ASSY. FIXTURE (MANUAL)			.15									
20	OBTAIN DETAIL #16 CUP AND POSITION TO ADAPTOR ON FIXTURE, ACTUATE LEVER TO SEAT CUP				.30									
30	OBTAIN DETAIL #20 GASKET, DETAIL #4 COVER, DETAIL #41, #48 BOLT, LOCKWASHERS FROM STOCK, POSITION GASKET & COVER AND LOOSE ASSEMBLE (4) BOLTS & WASHERS				.50									
40	SECURE BOLTS WITH POWER TOOL	PNEUMATIC RT. ANGLE NIPPRUNNER			.20									
					1.15									
TOTALS														
REMARKS														
Mfg. Development Engr. & Research		PROCESS ENGR. L. PALMER	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PRODM.	DAILY SERVICE DAILY PLT. PLANNING VOLUME	REQ'D. PER VEHICLE PC/HR.	NEXT ASSY: SUPERSEDES:	OPER. NO. 70				

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FORD AIRCRAFT

PROCESS ESTIMATE SHEET

PLANT

DEPARTMENT

PROGRAM OR CEA NO.		PART NAME				ISSUE DATES		PART NO.						
FORD MODELS		ASSEMBLE BEARING CUP TO ATTACH. HOUSING				9-11-80		D-651140-18A						
ELEVATION DRIVE ASSEMBLY		MATERIAL		WT./	RGH.	FIN.	RELEASE		SHEET 1 OF 1					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
	PARTS REQUIRED: (1) DETAIL #2 ATTACH. HOUSING (1) DETAIL #18 TIMKEN CUP					TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
10	OBTAIN DETAIL #2 ATTACH. HOUSING FROM STOCK AND POSITION IN PRESS	ARBOR PRESS			.20									
20	OBTAIN DETAIL #18 CUP, POSITION TO DETAIL ON ARBOR PRESS, PRESS INTO HOUSING				.30									
30	TRANSFER HOUSING TO NEXT OPERATION				.10									
TOTALS					.60									
REMARKS														
PROCESS ENGR.		PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:		OPER. NO.		
I. PALMER						DAILY PLY. PLANNING VOLUME		REQ'TS. PC/HR. HRS.		SUPERSEDES:		80		
INDUSTRY ENGR.		LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.									
S. LEWIS														

Mfg. Development  
Engrg. & Research

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PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

DEPARTMENT:

PROGRAM OR ECR NO.		PART NAME			ISSUE DATES		PART NO.							
ELEVATION DRIVE ASSEMBLY		ASSEMBLE WORM HOUSING TO ELEV. SHAFT HOUSING			9-11-80		D-651140-18A							
FOR MODELS		MATERIAL		WT./LBS.	RGH.	FIN.	RELEASE	SHEET						
ELEVATION DRIVE ASSEMBLY								1 OF 1						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'Y REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYS/PT	
	PARTS REQUIRED:													
(1)	DETAIL #2 HOUSING FROM OPER. #80													
(4)	DETAIL #43 LOCKWASHER													
(4)	DETAIL #43 BOLT													
(1)	DETAIL #20 GASKET													
(2)	DETAIL #33 SPIROL PIN													
10	OBTAIN DETAIL #2 HOUSING, DETAIL #43 BOLTS, DETAIL #20 GASKET FROM STOCK POSITION GASKET & ATTACH HOUSING TO ELEV. SHAFT HOUSING & LOOSE ASSEMBLE (4) BOLTS & (4) WASHERS	ELEVATOR DRIVE ASS'Y FIXTURE			.75									
20	DEPART DETAIL #33 SPIROL PINS & INSTALL (2) PINS INTO ATTACH HOUSING	TOOL TO DRIVE IN SPIROL PINS			.40									
30	SECURE (4) BOLTS WITH POWER TOOL	PNEUMATIC NUTRUNNER			20									
TOTALS					1.35									
REMARKS														
PROCESS ENGR. I. PALMER		PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO.				
INDUSTRY ENGR.		LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS.	SUPERSEDES:		90				
Mfg. Development Engng. & Research							PC/NR.	HRS.						

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PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

PROGRAM OR EEM NO.		PART NAME				ISSUE DATES		DEPARTMENT							
FOR MODELS		MATERIAL				WT./	RGH.	FIN.	PART NO.		RELEASE				
ELEVATION DRIVE ASSEMBLY		ASSEMBLE GEAR TO ELEV. WORM							D-651140-18A		SHEET 1 OF 1				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
	PARTS REQUIRED:														
	(1) DETAIL #51 GEAR														
	(1) DETAIL #30 GEAR														
	(1) DETAIL #32 SPIRON PIN														
10	OBTAIN DETAIL #51 GEAR, DETAIL # 30 KEY & DETAIL # 32 PIN FROM STOCK				.20										
20	POSITION KEY TO SLOT IN SHAFT ON WORM, POSITION GEAR TO SHAFT	ELEVATOR DRIVE ASS'Y. FIXTURE			.25										
30	INSERT SPIROL PIN IN GEAR	DRIVE TOOL.			.15										
TOTALS					.60										
REMARKS															
PROCESS ENGR. I. PALMER		PLY. LAYOUT		AUTOMATION		DESIGN		MATE. MOLD. ENGR.		DAILY SERVICE		REQ'D. PER VEHICLE		WENT ASSY:	
INDUSTY. ENGR.		LAB.		QUAL. CONTR.		PLT. ENGR.		PRODN.		DAILY PLT. PLANNING VOLUME		REQMTS. PC/HR. HRS.		SUPERSEDES:	
Mfg. Development Engrg. & Research															
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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROC. PLAN OR ECR NO.		PART NAME				ISSUE DATES		PART NO.						
ELEVATION DRIVE ASSEMBLY		ASSEMBLE SEAL TO ATTACH. HOUSING CAP				9-11-80		D-651140-18A						
FOR MODELS		MATERIAL		WT./	RGH.	FIN.	RELEASE		SHEET		OF			
				LBS.										
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT			EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
		DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQ'D.	NET HOURLY CAP		TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
	PARCS REQUIRED: (1) DETAIL #6 CAP (1) DETAIL #23 SEAL GARLOCK													
10	OBTAIN DETAIL #6 CAP FROM STOCK & PLACE ON PRESS	ARBOR PRESS			.25									
20	OBTAIN DETAIL #23 SEAL, POSITION TO CAP & PRESS IN PLACE				.30									
30	TRANSFER TO NEXT OPERATION				.10									
TOTALS					.60									
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO. 110			
		INDUSTY. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODM.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR.	HRS.	SUPERSEDES:				

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PLANT FORD AEROSPACE

## PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR ECM NO.		PART NAME				ISSUE DATES		PART NO.						
ELEVATION DRIVE ASSEMBLY		ASSEMBLE WORM TO ATTACH. HOUSING				9-11-80		D-651140-18A						
FOR MODELS		MATERIAL		WT./	RGH.	FIM.	RELEASE		SHEET					
				LBS.					1 OF		1			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.V. NUMBER	MACH'S RECD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. PRVCT	
	PARTS REQUIRED:													
	(2) DETAIL #17 TIMKEN CONE													
	(1) DETAIL #50 WORM													
	(1) DETAIL #18 TIMKEN CUP													
	(1) DETAIL #21 GASKET													
	(1) DETAIL #6 CAP (FROM OPER. #110)													
	(4) DETAIL #42 BOLT													
	(4) DETAIL #48 LOCKWASHER													
10	OBTAIN (2) DETAIL #17 CONE, (1) DETAIL #50 WORM FROM STOCK, POSITION (1) CONE IN ATTACH, HOUSING, INSERT WORM, ASSEMBLE (1) CONE TO WORM SHAFT	ELEVATOR DRIVE ASS'Y FIXTURE (MANUAL)			45									
20	OBTAIN DETAIL #18 CUP & POSITION OVER WORM SHAFT, PRESS IN PLACE	MANUAL - HAND TOOL			30									
30	OBTAIN DETAIL #21 GASKET, DETAIL #6 CAP, (4) EA. DETAIL #42, 48 BOLTS & WASHERS, POSITION GASKET & COVER OVER SHAFT & LOOSE ASSEMBLE (4) BOLTS & WASHERS	MANUAL			50									
40	SECURE BOLTS WITH POWER TOOL	PNEUMATIC RT. ANGLE NUTRUNNER			20									
TOTALS					1.45									
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR. L. PALMER	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO.			
		INDUSTY. ENGR. D. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES.		120			

PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR ECR NO.		PART NAME				ISSUE DATES		PART NO.							
		ASSEMBLE SEAL TO MOTOR ADAPTOR				9-15-80		D-651140-18A							
FOR MODELS		MATERIAL			WT./	RGH.	FIN.	RELEASE		SHEET 1 OF 1					
ELEVATION DRIVE ASSEMBLY					LBS.										
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REPO.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
	PARTS REQUIRED: (1) DETAIL #7 MOTOR ADAPTER (1) DETAIL #23 SEAL														
10	OBTAIN DETAIL #7 MOTOR ADAPTER FROM STOCK AND POSITION ON PRESS	ARBOR PRESS			.20										
20	OBTAIN DETAIL #23 SEAL & POSITION TO ADAPTER AND PRESS INTO MOTOR ADAPTER				.30										
30	TRANSFER ASSEMBLY TO NEXT OPERATION				.10										
TOTALS					.60										
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:		OPER. NO. 130		
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME		REQMTS. PC/HR. HRS.		SUPERSEDES.				

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR ECR NO.		PART NAME ASSEMBLE COVER TO ATTACH. HOUSING				ISSUE DATES 9-15-80		PART NO. D-651140-18A							
FOR MODELS ELEVATION DRIVE ASSEMBLY		MATERIAL		WT./ LBS.	RGH.	FIN.	RELEASE	SHEET 1 OF 1							
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTAL- LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
	PARTS REQUIRED: (1) DETAIL #3 COVER (1) DETAIL #22 GASKET (4) DETAIL #41 BOLT (4) DETAIL #48 LOCK WASHER														
10	OBTAIN DETAIL #3 COVER & DETAIL #22 GASKET, POSITION GASKET & COVER TO ATTACH. HOUSING, LOOSE ASSEMBLE (4) DETAIL #41 & (4) DETAIL #48 BOLTS & WASHERS	ELEVATOR DRIVE ASSEMBLY FIXTURE			.50										
20	SECURE (4) BOLTS WITH POWER TOOL	PNEUMATIC RT. ANGLE NUTRUNNER			.20										
TOTALS					.70										
REMARKS															
PROCESS ENGR. L. PALMER		PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO.					
INDUSTY. ENGR.		LAB.	QUAL. CONTR.	PLT. ENGR.	PRODM.	DAILY PLT. PLANNING VOLUME	REQMYS. PC/HK.	SUPERSEDES.		140					

McG. Development  
Engrg. & Research

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR EEA NO.		PART NAME			ISSUE DATES		PART NO.								
ELEVATION DRIVE ASSEMBLY		ASSEMBLE MOTOR ADAPTER TO ATTACH. HOUSING			9-15-80		D-651140-18A								
FOR MODELS		MATERIAL		WT./	RGH.	FIN.	RELEASE		SHEET 1 OF 1						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.Y. NUMBER	MACH'S. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. PRYOUT		
	PARTS REQUIRED:														
	(1) DETAIL #7 MOTOR ADAPTER ( FROM PREV. OPER.)														
	(1) DETAIL #21 GASKET														
	(4) DETAIL #43 BOLT														
	(4) DETAIL #48 LOCKWASHERS														
10	OBTAIN DETAIL #7 MOTOR ADAPTER & DETAIL #21 GASKET, POSITION TO ATTACH. HOUSING, LOOSE ASSEMBLE (4) DETAIL #43 BOLTS & (4) DETAIL #48 LOCKWASHERS	ELEVATOR DRIVE ASS'Y FIXTURE			.50										
20	SECURE BOLTS WITH POWER TOOL	PNEUMATIC RT. ANGLE NUTRUNNER			.20										
TOTALS					.70										

REMARKS

Mfg. Development Engr. & Research	PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO. 150
	I. PALMER	INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRDGN.	DAILY PLT. PLANNING VOLUME	REQ'TS. PC/NR. HRS.	

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PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

PROGRAM OR CEA NO.		PART NAME				ISSUE DATES		DEPARTMENT					
FOR MODEL ELEVATION DRIVE ASSEMBLY		ASSEMBLE COUPLING TO ELEVATOR MOTOR				9-15-80		PART NO. D-651140-18A, 531436					
		MATERIAL		WT./LBS.	RGH.	FIN.	RELEASE		SHEET 1 OF 1				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQ'D.	NET HOURLY CAP.	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	
	PARTS REQUIRED: (1) DETAIL #40 KEY (DWG. #D-651140-18A) (1) DETAIL #39 COUPLING (DWG. #D-651140-18A) (1) DETAIL #31 MOTOR (DWG. #531436)												
10	OBTAIN DETAIL #31 MOTOR & POSITION ON BENCH	BENCH			.20								
20	OBTAIN DETAIL #40 KEY & DETAIL #39 COUPLING, INSERT KEY IN SLOT ON MOTOR SHAFT & ASSEMBLE COUPLING	MANUAL			.40								
30	SECURE SET SCREW IN COUPLING TO MOTOR SHAFT	HAND TOOL			.15								
40	TRANSFER MOTOR TO NEXT OPERATION				.10								
TOTALS					.85								
REMARKS													
Mfg. Development Engrg. & Research		PROCESS ENGR. L. PALMER	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.		160	
		INDUSTR. ENGR.	LAW.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS.	SUPERSEDES:				
								PC/HR.	HRS.				

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FORD AEROSPACE

PROCESS ESTIMATE SHEET

PROGRAM OR CEA NO.		PART NAME				ISSUE DATES		DEPARTMENT							
FOR MODELS ELEVATOR DRIVE ASSEMBLY		ASSEMBLE MOTOR TO MOTOR ADAPTER				9-15-80		PART NO. 531436							
		MATERIAL		WT./LBS.	RGH.	FIN.	RELEASE		SHEET 1 OF 1						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRVOLS		
	PARTS REQUIRED:														
	(1) DETAIL #31 (FROM PREV. OPER.)														
	(4) DETAIL #36 BOLT														
	(4) DETAIL #37 PLAT WASHER														
	(4) DETAIL #38 LOCK WASHER														
10	OBTAIN DETAIL #31 MOTOR FROM STOCK POSITION TO MOTOR ADAPTER WHILE SLIDING COUPLING OVER WORM SHAFT & LOOSE ASSEMBLE (4) DETAIL #36 BOLTS, (4) DETAIL #37 PLAT WASHER, (4) DETAIL #38 LOCK WASHER	ELEVATOR DRIVE ASSEMBLY FIXTURE			.50										
20	SECURE (4) BOLTS WITH POWER TOOL	PNEUMATIC RT. ANGLE NUTRUNNER			.20										
30	SECURE SET SCREW IN COUPLING TO WORM SHAFT THRU HOLE IN MOTOR ADAPTER	HAND TOOL			.15										
TOTALS					.85										
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR. T. PALMER	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO. 170					
		INDUSTRY ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:						

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR CER NO.		PART NAME				ISSUE DATES		PART NO.							
ELEVATOR DRIVE ASSEMBLY		ASSEMBLE PIPE PLUGS & ALEMITE FITTING				9-15-80		D-651140-18A							
FOR MODELS		MATERIAL		WT./LBS.	RGH.	FIN.	RELEASE		SHEET						
									1 OF 1						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
	PARTS REQUIRED:														
	(4) DETAIL #34 PIPE PLUGS														
	(3) DETAIL #35 PIPE PLUGS														
	(1) DETAIL #36 PIPE PLUGS														
	(1) DETAIL #37 ALEMITE														
	(1) DETAIL #38 ALEMITE														
10	ASSEMBLE (4) DETAIL #34, (3) DETAIL #35 & (1) DETAIL #36 PIPE PLUGS TO ELEVATOR DRIVE ASSEMBLY	ELEVATOR DRIVE ASSEMBLY FIXTURE			.40										
		PNEUMATIC RT. ANGLE NOT RUNNER													
20	ASSEMBLE (1) DETAIL #37 & (1) DETAIL #38 ALEMITE FITTING TO ELEVATOR DRIVE ASSY.				.30										
TOTALS					.70										
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR. I. PALMER	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
		INDUSTRIAL ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/NR. HRS.	SUPERSEDES:	180					

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PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

DEPARTMENT

PROGRAM OR ECR NO.		PART NAME LUBRICATE ELEVATOR DRIVE				ISSUE DATES 9-15-80		PART NO. D-651140-18A							
FOR MODELS ELEVATION DRIVE ASSEMBLY		MATERIAL				WT./ RGH. FIN. LBS.		RELEASE		SHEET 1 OF 1					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRAVEL		
	PARTS REQUIRED: (AR) LUBRICANT														
10	LUBRICATE ELEVATOR DRIVE ASSEMBLY (2) LOCATIONS THRU ALUMITE FITTINGS	LUBRICATION EQUIPMENT ELEVATOR DRIVE ASSEMBLY FIXTURE			.20										
TOTALS															
REMARKS															
Mfg. Development Engng. & Research		PROCESS ENGR. I. PALMER	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. HDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO. 190					
		INDUSTRY ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR.	NRG.	SUPERSEDES:					

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PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

PROGRAM OR CCA NO.		PART NAME				ISSUE DATES		DEPARTMENT							
FOR MODELS		SUB-ASSEMBLY MAGNET HOLDER TO REV. COUNTER ADAPTER				9-15-80		PART NO. 531436							
ELEVATION DRIVE ASSEMBLY		MATERIAL		WT./LBS.	RGH.	FIN.	RELEASE	SHEET 1 OF 1							
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRUCK		
(1)	PARTS REQUIRED: (1) DETAIL #5 SLEEVE (1) DETAIL #8 MOUNT, PC BOARD (1) DETAIL #9 PC BOARD (1) DETAIL #10 ADJUSTER, PC BOARD (2) DETAIL #49 SCREW (2) DETAIL #50 FLAT WASHER (2) DETAIL #51 LOCK WASHER (1) DETAIL #52 NUT (1) DETAIL #53 RETAINING RING (1) DETAIL #54 SPRING (1) DETAIL #55 DOWEL PIN														
10	COMPAIN DETAIL #5 SLEEVE AND DRIVE DETAIL #55 PIN THRU 1/8 DIA. HOLE	SUB-ASSEMBLY FIXTURE MALLET			.40										
20	POSITION DETAIL #9 PC BOARD TO DETAIL #8 MOUNT & SECURE WITH (2) DETAIL #49, 50 & 51 SCREWS, F/WASHERS & I/WASHERS	PNEUMATIC PISTOL GRIP SCREWDRIVER			.30										
30	PRE-ASSEMBLE DETAIL #52 NUT TO DETAIL #10 ADJUSTER AND ASSEMBLE THRU SLEEVE & DET. #54 SPRING, POSITION PC BOARD ASSEMBLY OVER DOWEL PIN & ADJUSTER & SECURE WITH DET. #53 RETAINING RING	MANUAL HAND TOOL			.75										
TOTALS						1.45									
REMARKS															
Mfg. Development Engg. & Research		PROCESS ENGR. I. PALMER	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO.				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODM.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HRS.	SUPERSEDES		HRS.				

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR ECR NO.		PART NAME				ISSUE DATES		PART NO.						
FOR MODELS		SUB-ASSEMBLY REV. COUNTER ADAPTER TO SLEEVE				9-15-80		531436						
ELEVATION DRIVE ASSEMBLY		MATERIAL		WT./	RGH.	FIN.	RELEASE		SHEET 1 OF 1					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYG/PT	EXPENSE COST
	PARTS REQUIRED: (1) SLEEVE SUB-ASSEMBLY (FROM PREV. OPER.) 1) DETAIL #6 ADAPTER, REV. COUNTER (AR) DETAIL #43 PERMATEx (4) DETAIL #45 SCREW (4) DETAIL #46 FLAT WASHER (4) DETAIL #47 LOCK WASHER													
10	APPLY DET. #43 PERMATEx TO DETAIL #6 ADAPTER	SUB-ASSEMBLY FIXTURE			.15									
		HAND BRUSH												
20	POSITION ADAPTER TO SLEEVE & SECURE WITH (4) DET. #45 SCREW, (4) DET #46 F/WASHER & (4) DET. #47 L/WASHER	PNEUMATIC PISTOL GRIP SCREWDRIVER			.50									
30	REMOVE SLEEVE & ADAPTER ASSEMBLY FROM FIXTURE & TRANSFER TO NEXT ASSEMBLY OPERATION				.15									
TOTALS					.80									
REMARKS														
PROCESS ENGR. T. PALMER		PLY. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE		NEXT ASSY:		OPER. NO.			
INDUSY. ENGR. S. LEWIS		LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLY. PLANNING VOLUME	REQMTS. PC/HR. HRS.		SUPERSEDES.		210			
Mfg. Development Engrg. & Research														

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22A

PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

DEPARTMENT:

PROGRAM OR ECR NO.		PART NAME ASSEMBLE MAGNET HOLDER TO WORM SHAFT				ISSUE DATES 9-15-80		PART NO. 531436							
FOR MODELS ELEVATOR DRIVE ASSEMBLY		MATERIAL		WT./ LBS.	RGH.	FIN.	RELEASE		SHEET OF						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYG. CT		
	PARTS REQUIRED: (1) DETAIL #11 MAGNET HOLDER, REV. COUNTER (1) DETAIL #48 SET SCREW														
10	OBTAIN DET. #11 MAGNET HOLDER & DET. #48 SET SCREW, POSITION MAGNET HOLDER TO WORM SHAFT ON ELEVATOR DRIVE ASSEMBLY, SECURE WITH SET SCREW	ELEVATOR DRIVE ASSEMBLY FIXTURE HAND TOOL			.30										
TOTALS					.30										
REMARKS															
PROCESS ENGR. I. PALMER		PLT. LAYOUT		AUTOMATION		DESIGN		MATH. MDLG. ENGR.		DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:	
INDUSTR. ENGR.		LAW.		QUAL. CONTR.		PLT. ENGR.		PRODN.		DAILY PLT. PLANNING VOLUME		REQMTS. PC/HR. HRS.		SUPERSEDES:	
Mfg. Development Engrg. & Research															220

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR ECR NO.		PART NAME ASSEMBLE REV. COUNTER ADAPTER/SLEEVE TO ELEV. DRIVE				ISSUE DATES 9-15-80		PART NO. 531436							
FOR MODELS ELEVATION DRIVE ASSEMBLY		MATERIAL		WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 1 OF 1						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACH'G REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTAL- LATION	TOTAL	DESIGN	BUILD	INST. FACILITIES		
	PARTS REQUIRED: (1) REV. COUNTER ADAPTER/SLEEVE (FROM PREV. OPER.) (AR) DET. #43 PERMATEX (4) DET. #34 FLAT WASHER (4) DET. #35 LOCK WASHER (4) DET. #44 SCREW 1/4-20														
10	OBTAIN ADAPTER/SLEEVE SUB-ASSEMBLY AND APPLY DET. #43 PERMATEX	HAND BRUSH			.15										
20	POSITION ADAPTER/SLEEVE SUB-ASSEMBLY TO ELEVATOR DRIVE ASSEMBLY AND SECURE WITH (4) DETAIL #34 F/WASHERS, (4) DETAIL #35 L/WASHERS & (4) DET. #44 SCREWS	ELEVATOR DRIVE ASSEMBLY FIXTURE  PNEUMATIC PISTOL GRIP NUTRUNNER			.50										
TOTALS					.65										
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR. L. PALMER	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO. 230					
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HRS. HRS.	SUPERSEDES:						

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PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

PROGRAM OR CTR NO.		PART NAME				ISSUE DATES			DEPARTMENT					
FOR MODELS		MATERIAL				WT./	RGH.	FIN.	PART NO.		SHEET		OF	
ELEVATOR DRIVE ASSEMBLY		ADJUST GAP BETWEEN MAGNET & IC'S				LBS.			9-15-80		1		1	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRYSCT	
	PARTS REQUIRED:													
	NONE													
10	ADJUST GAP BETWEEN MAGNET ON WORM SHAFT & IC'S (PC BOARD) USING .015" FEELER GAGE	ELEVATOR DRIVE ASSEMBLY FIXTURE HAND TOOL FEELER GAGE			.30									
TOTALS					.30									
REMARKS														
Mfg. Development Engg. & Research		PROCESS ENGR. L. PALMER	PLY. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLY. PLANNING VOLUME		REQ'D. PER VEHICLE PC/NR.	REQMTS. HRS.	NEXT ASSY: SUPERSEDES:		OPER. NO. 240	

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR ECR NO.		PART NAME ASSEMBLY COVER TO MOTOR REV. COUNTER				ISSUE DATES 9-15-80		PART NO. 531436						
FOR MODELS ELEVATOR DRIVE ASSEMBLY		MATERIAL		WT./LBS.	RGH.	FIN.	RELEASE		SHEET 1 OF 1					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	EXPENSE COST
	PARTS REQUIRED:													
	(1) DETAIL #7 COVER, MOTOR REV. COUNTER													
	(1) DETAIL #27 GASKET													
	(4) DETAIL #45 SCREW #10-32													
	(4) DETAIL #46 FLAT WASHER													
	(4) DETAIL #47 LOCK WASHER													
10	OBTAIN DETAIL #7 COVER & DETAIL #27 GASKET, POSITION GASKET & COVER TO MOTOR REV. COUNTER AND SECURE WITH (4) DET. #45 SCREW, (4) DET. #46 FLAT WASHER & (4) DET. #47 LOCKWASHER	ELEVATOR DRIVE ASSEMBLY FIXTURE  PNEUMATIC PISTOL GRIP SCREWDRIVER			.60									
20	RELEASE CLAMP FROM ELEVATOR DRIVE ASSEMBLY FIXTURE AND TRANSFER ASSEMBLY TO NEXT OPERATION				.15									
TOTALS					.75									
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR. I. PALMER	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PRDGN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME	REQ'D. PER VEHICLE PC/HR.	REQMTS. HRS.	NEXT ASSY: SUPERSEDES:	OPER. NO. 250			

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FORD AEROSPACE

PROCESS ESTIMATE SHEET

SHEET 27 of 29

22A

PROGRAM OR EEA NO.		PART NAME				ISSUE DATES		DEPARTMENT						
FOR MODELS		MATERIAL				WT./	RGH.	FIN.	PART NO.					
ELEVATION DRIVE ASSEMBLY						LBS.			D-651140-18A					
						9-15-80		RELEASE		SHEET 1 OF 1				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYS/21	
	PARTS REQUIRED:													
	(1) DETAIL #27 UPR. STOP COLLAR													
	(1) DETAIL #28 LWR. STOP COLLAR													
	(1) DETAIL #29 ACTUATOR NUT													
	(4) DETAIL #14 CAP SCREW (1/4-20)													
	(1) DETAIL #47 BOLT (3/4-16)													
10	OBTAIN ELEVATOR DRIVE ASSEMBLY FROM PREVIOUS OPERATION AND POSITION TO STOP COLLAR SETTING FIXTURE	FIXTURE TO SET UPPER & LOWER STOP COLLARS ON ELEV. DRIVE SHAFT			.25									
20	OBTAIN DETAIL #28 LWR. STOP COLLAR, DET. #29 ACTUATOR NUT & DETAIL #27 LWR. STOP COLLAR, ASSEMBLE TO ELEVATOR DRIVE SHAFT AND SECURE EACH LWR. STOP WITH (4) DETAIL #14 CAP SCREWS	PNEUMATIC RT. ANGLE NUTRUNNER			.50									
30	SECURE BOLT TO END OF ELEVATOR SHAFT	BOX END WRENCH			.40									
40	REMOVE ASSEMBLY & TRANSFER TO BOXING & SHIPPING AREA				.10									
TOTALS					1.25									
REMARKS														

Mfg. Development Engrg. & Research	PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO. 260
	INDUSTA. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR.	SUPERSEDES:	
	S. LEWIS								

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22A

PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

PROCESS OR CEA NO.		PART NAME				ISSUE DATES				DEPARTMENT				
FOR MODELS		MATERIAL				WT./LBS.	RGH.	FIN.	9-19-80		PART NO.		RELEASE	SHEET 1 OF 1
ELEVATION DRIVE ASSEMBLY		FACILITY & TOOLING COST SUMMARY												
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. BY CAT	
	FIXTURES/AIDS					21,000	15,000	1,000	5,000	50,000				
		ARBOR PRESS	2											
		BEARING PACKERS	2											
		SUB-ASSEMBLY FIXTURES	4											
		PNEUMATIC TOOLS												
		DRIVE ASSEMBLY FIXTURE	18											
		LUBRICATION EQUIPMENT				4,500	1,000	500	3,000	9,000				
		HAND TOOLS												
		ASSEMBLY CONVEYOR				19,000	14,000	1,000	4,000					
		SINGLE SLAT WITH MOUNTED FIXTURES 28' LONG												
		SECONDARY LIGHTING				1,000	500		500					
TOTALS						45,500				59,000				
REMARKS: FLOOR SPACE = 2500 SQ. FT. FAC. 45,500 TOOL 59,000														
PROCESS ENGR. I. PALMER		PLT. LAYOUT		AUTOMATION		DESIGN		MATH. MDLG. ENGR.		DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:
INDUSTY. ENGR.		LAB.		QUAL. CONTR.		PLT. ENGR. OHANESTAN		PRODN.		DAILY PLT. PLANNING VOLUME		REQMTS. PC/MR. HRS.		SUPERSEDES:
Mfg. Development Engng. & Research														

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BENCH  
FIXTURE

WORM-SHAFT  
& HOUSING  
ASSY.

BENCH  
FIXTURE

S.S. SHAFT  
& BEARING  
ASSY.

BENCH

MOTOR &  
COUPLING  
ASSY.

BENCH  
PRESS

1 2 PRESS/ASSEMBLE  
CONE & SEALS  
INTO HOUSINGS

BENCH

APPLY LUBRICANT  
TO SEALS & BEARINGS

SUB-ASSEMBLIES

STATION-7

UNLOAD ASSEMBLY  
PLACE IN RACK  
FOR DELIVERY TO  
PAINT AREA

STATION-5

ASSEMBLE P.C. BOARD-  
ADAPTDR & SLEEVE  
ASSEMBLE MAGNET  
HOLDER- ADJUST GAP  
ASSEMBLE STOP COLLAR

STATION-3

ASSEMBLE MOTOR  
TO SHAFT.  
ASSEMBLE LUB.  
FITTINGS & PLUGS  
FILL WITH LUB. OIL

STATION-1

LOAD HOUSING INTO  
FIXTURE  
ASSEMBLE S.S. SHAFT  
INTO HOUSING.  
ASSEMBLE ATTACHMENT  
HOUSING TO ELEVATOR  
(S.S. SHAFT) HOUSING.



STATION-6

FUNCTIONAL TEST

STATION-4

IDLE

STATION-2

ASSEMBLE H.S. WORM  
TO SHAFT  
ASSEMBLE MOTOR ADAPTDR  
AND COUPLING TO H.S. SHAFT

ELEVATION ~~AREA~~ ASSEMBLY  
651140-18A -- 531436  
FLOOR SPACE = 2500 SQ. FT.

J. DHANESIAN 9-23-80

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PROCESS ESTIMATE SHEET

PROGRAM OR CEA NO.		PART NAME			ISSUE DATES			DEPARTMENT:							
HELIOSTAT		HOUSING - EL.			9-9-80			PART NO.							
FOR MODELS		MATERIAL			WT./			65148-28		SHEET 1 OF 4					
ELEVATION DRIVE ASSEMBLY		MEEMANITE (DUCTILE IRON) CAST'G.			RGM. FIN.			RELEASE							
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRAVEL		
05	RECEIVE CASTINGS														
10	ROUGH & FIN. MILL TOP SURFACE - B	SPEC. (6) STA. SHUTTLE MACH.		12	4.14	440,000	400,000	5,000	35,000	120,000					
	CORE DRILL & SEMI-FIN. BORE 3.75 I.D.-C-, & 3.12 I.D.	GAGES				1,000			1,000	15,000					
	DRILL (6) .307 TAP DRILL HOLES-, 88 DEEP														
	REAM (1) HOLE FOR MFG. PURPOSES														
EST.	F. TO F. - 3.3 MIN.														
20	R. & F. MILL 5.627 DIM. (SURF-B- & OPP. FACE)	HORIZ. MILLING MACH. W/GANG ARBOR & (2) POS. FIXTURE		26	1.88	120,000	110,000	2,000	8,000	30,000					
	EST. F. TO F. - 1.5 MIN.	GAGES				1,000			1,000	10,000					
TOTALS						562,000				175,000					
REMARKS															
Mfg. Development Engg. & Research		PROCESS ENGR. H. GOVE	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
		INDUSTR. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESIAN	PRODN.	DAILY PLT. PLANNING VOLUME	REQ'TS. 13 PC/NR. 16 HRS.	SUPERSEDES:						

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PROCESS ESTIMATE SHEET

PLANT		PROGRAM OR ECR NO.						PART NAME				ISSUE DATES				DEPARTMENT			
		HOUSING-EI.										PART NO. 651140-22							
FOR MODELS		MATERIAL						WT./RGH. FIN.				RELEASE SHEET 2 OF 4							
ELEVATION DRIVE ASSEMBLY								LBS.											
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQ.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST					
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT						
30	R. & F. MILL 1.000 DIM. TANG	HORIZ. MILLING MACH. W/FACE MILL & INDEX FIXTURE		13	3.75	99,000	90,000	2,000	7,000	30,000									
	EST. F. TO F. - 3.0 MIN.	GAGES								5,000									
40	CORE DRILL & SEMI-PIN. BORE 1.8514 & 1.253 I.D.S.	SPEC. (3) WAY DRILL MACH.		19	2.50	130,000	120,000	2,000	10,000	30,000									
	CYCLE RUN BY CHANGING TOOLS - EST. CHANGE-OVER TIME 1.0 HOUR	GAGES								5,000									
	EST. F. TO F. - 2.0 MIN.																		
50	DRILL & TAP (8) .250-20 HOLES DRILL, REAM & TAP (2) .250 PIPE TAP HOLES	SPEC (6) POS. SHUTTLE DRILL & TAP MACH.		13	3.75	274,000	250,000	4,000	20,000	80,000									
	EST. F. T. F. - 3.0 MIN'S.	GAGES								3,000									
TOTALS						503,000				153,000									
REMARKS																			
Mfg. Development Engr. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.									
		INDUSTY. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:										

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PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO.		PART NAME				ISSUE DATES				DEPARTMENT				
FOR MODELS ELEVATION DRIVE ASSEMBLY		MATERIAL				WT./ LBS.	RGH.	FIN.	PART NO. 651140-22					
										RELEASE	SHEET 3	OF 4		
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRYS/CT	EXPENSE COST
60	END ROBE 3.750, 3.123, 1.253 & 1.8514 & FIN. GENERATE ADJ. FACES IF REQ'D FOR SQ'NESS TOLERANCES	SPEC. (4) WAY ROBE MACH		13	3.75	440,000	400,000	5,000	35,000	160,000				
	EST. F. TO F. - 3.0 MIN.	GAGES				7,000	2,000		5,000	60,000				
70	TAP (G) .375 - 16 HOLES DRILLED AT OPER. 10 & DRILL REAM & TAP (1) PIPE TAP HOLE IN SAME PLANE	VERT. THRETT DRILL PRESS		19	2.50	88,000	80,000	1,000	7,000	15,000				
	EST. F. TO F. - 2.0 MIN.	GAGES								2,000				
75	WASH USED FOR ALL SMALL CAST IRON PARTS													
80	FINAL INSPECT & TRANS. - PORT TO GEAR ASSY.													
	PERSONAL RELIEF				1.49									
TOTALS					23.76	542,000				377,000				
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTRI. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQ'TS. PC/HR. HRS.	SUPERSEDES:					

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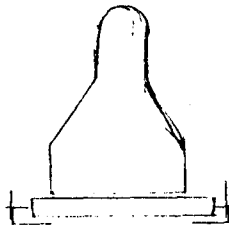
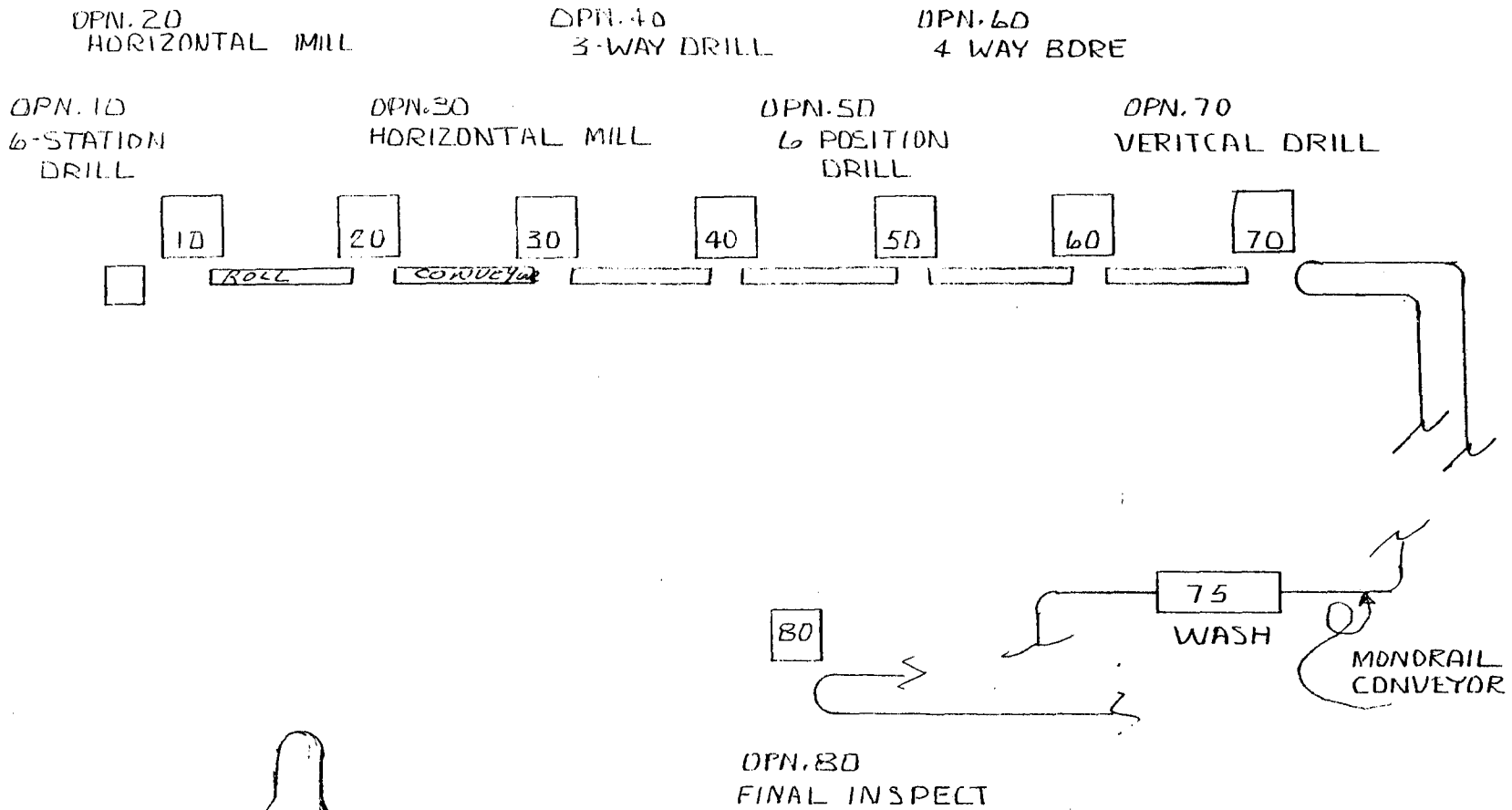
PROCESS ESTIMATE SHEET

PROGRAM OR EQM NO. HELIOSTAT		PART NAME HOUSING - ELEVATION			ISSUE DATES 9-10-80		DEPARTMENT PART NO. 651140-22 <span style="float:right">23</span>							
FOR MODELS ELEVATION DRIVE ASSEMBLY		MATERIAL PLANT ENGINEERING REQUIREMENTS			WT./ LBS.	RGM.	FIN.	RELEASE	SHEET 4 OF 4					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR M.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST.	EXPENSE
1	CHPP - COOLANT AND CLARIFICATION SYSTEMS					112,000	70,000	7,000	35,000					
2	COOLANT REFRIGERATION SYSTEM													
3	EXHAUST - FUME - DUST AND VENTILATION													
4	CCP FIRE PROTECTION SYSTEM					80,000	40,000		40,000					
5	MONORAIL CONVEYORS													
6	MONORAIL CARRIERS (COOLING)									50,000				
7	ROLLER CONVEYOR					10,200	7,000	200	3,000					
8	POWERED CONVEYERS													
9	PLATFORMS - STILES													
10	STRETCH RAILS AND HOISTS													
11	TOOL CABINETS - RACKS AND STANDS					2,000	1,000		1,000					
12	TOOL CONTROL ECARDS													
13	WORK - GAGING AND INSPECTION TABLES					12,000	8,000		4,000					
14	PARTS BASKETS (EXPENSE)													
15	PROMOTION AIDS - ASSEMBLY AIDS													
16	SECONDARY LIGHTING													
17	PROGRAMMABLE CONTROLLERS													
18	AUTOMATION - PART HANDLING SYSTEM													
19	ENGINEERING SERVICES DESIGN - (EXPENSE)													10,000
20	BUILDING SERVICES - UTILITIES													
21	POWER AND FREE CONVEYOR SYSTEM													
22	POWER AND FREE CONVEYOR CARRIERS (COOLING)													
23	MACHINE FOUNDATIONS AND DECKS													
24	PLANT REARRANGEMENT (EXPENSE)													
25	MATERIALS HANDLING - RACKS - CONTAINERS - DUNNAGE					3,000	2,000		1,000					
BUILDING CONSTRUCTION						4800 SQ. FT.								
TOTALS						219,200			5,000	10,000				

REMARKS TOTALS: PAC. - 1,826,200 )  
 TOOLG - 670,000 ) 2,506,200  
 10,000 )

PROCESS COST	PLT. LAYOUT	AUTOMATION	DESIGN	INT. BLDG. COST	DAILY SERVICE	REQD. PER VEHICLE	HEAT ASST.	STORAGE
					DAILY PLY. PLANNING	INVENTORY		

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1" DIAMETER ROLLERS  
ON 1 1/2" CENTERS  
FOR PART CONVEYANCE  
BETWEEN MACHINING  
OPERATIONS

AREA = 4800 SQ FT.

HOUSING - ELEVATION  
651140-22



PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO.		PART NAME			ISSUE DATES		DEPARTMENT							
HELIOSTAT		ATTACHMENT HOUSING			9-9-80		C-651140-46A							
FOR MODELS		MATERIAL			WT./	RGH.	FIN.	RELEASE		SHEET 1 OF 4				
ELEVATION DRIVE ASSEMBLY		CAST IRON - CLASS 20 MIN.			LB.			4-8-80						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQ'D.	NET HOURLY CAP.	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. FY/CYCLE	
05	RECEIVE CASTINGS													
10	ROUGH & FIN. TURN 1.849/ 1.848 DIA., ADJACENT FACES & 45° CHAMFER - CORE DRILL 1.349 DIA. HOLE	AUTO. LATHE  GAGES	1	12	4.14	120,000	110,000	2,000	8,000	15,000				
EST	P. TO P. - 3.3 MIN.									3,000				
20	SEMI-FINISH TOP SURFACE & (2) SIDES (3.752 DIA.)  DRILL & TAP (12) 1/4-20 HOLES ON TOP & SIDES  CORE DRILL 1.5755 DIA. ON (2) SIDES  (CONTINUED)	SPEC. (6) STA. SHUTTLE MACH. (2) PC./CYCLE	1	15	3.16	440,000	400,000	5,000	35,000	150,000				
						4,000	2,000		2,000	30,000				
TOTALS						564,000				198,000				
REMARKS														
Mfg. Development Engr. & Research		PROCESS ENGR. INDUSTR. ENGR. S. LEWIS	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR. OHANESIAN	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME	REQ'D. PER VEHICLE REQMTS. PC/HR. HRS.	NEXT ASSY: SUPERSEDES:	OPER. NO.				

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PROCESS ESTIMATE SHEET

PROGRAM OR CR NO.		PART NAME				ISSUE DATES				DEPARTMENT				
FOR MODELS		MATERIAL				WT./ RGM. FIN. LBS.				PART NO.		SHEET		
ELEVATION DRIVE ASSEMBLY		ATTACHMENT HOUSING								C-651140-46A		2 OF 4		
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQ.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
20	(CONTINUED)													
	DRILL & TAP (2) 1/8-27 PIPE TAP HOLES ON SIDES													
	DRILL (2) .125 DIA. HOLES 180° APART ON TOP													
	DRILL (4) .281 DIA. HOLES IN BOTTOM													
	EST. F. TO F. - 5.0 MIN/(2) PCS													
30	DRILL & TAP (3) 1/8-27 PIPE TAP HOLES - FRONT & REAR	SPEC. HORIZ. DRILL & TAP MACH.		26	1.00	55,000	50,000	1,000	4,000	20,000				
	EST. F. TO F. - 1.5 MIN.	GAGES								1,000				
TOTALS						55,000				21,000				
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:					

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PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO.		PART NAME				ISSUE DATES				DEPARTMENT					
FOR MODELS ELEVATION DRIVE ASSEMBLY		ATTACHMENT HOUSING								PART NO. c 651140-46A					
		MATERIAL				WT./ AGH. F.W. LBS.				RELEASE		SHEET 3 OF 4			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
40	FIN. BORE 1.249/1.251 & TURN 1.849/1.848 DIA. S.-	SPEC. (3) WAY PREC. BORING MACH.	1	15	3.16	230,000	210,000	4,000	16,000	70,000					
	FIN. BORE (2) 1.5755/1.5765 DIA. S & FIN. GENERATE ADJ. PACES	GAGES				4,000	2,000		2,000	40,000					
	EST. P.-P.-2.5 MIN.														
45	WASH														
50	FINAL INSPECTION & TRANSPORT TO GEAR ASSY.	GAGES				2,000	1,000		1,000	10,000					
	PERSONAL RELIEF				0.83										
TOTALS					13.17	236,000				120,000					
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PROON.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR.	SUPERSEDES: HRS.						

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CROSS ESTIMATE SHEET

PLANT

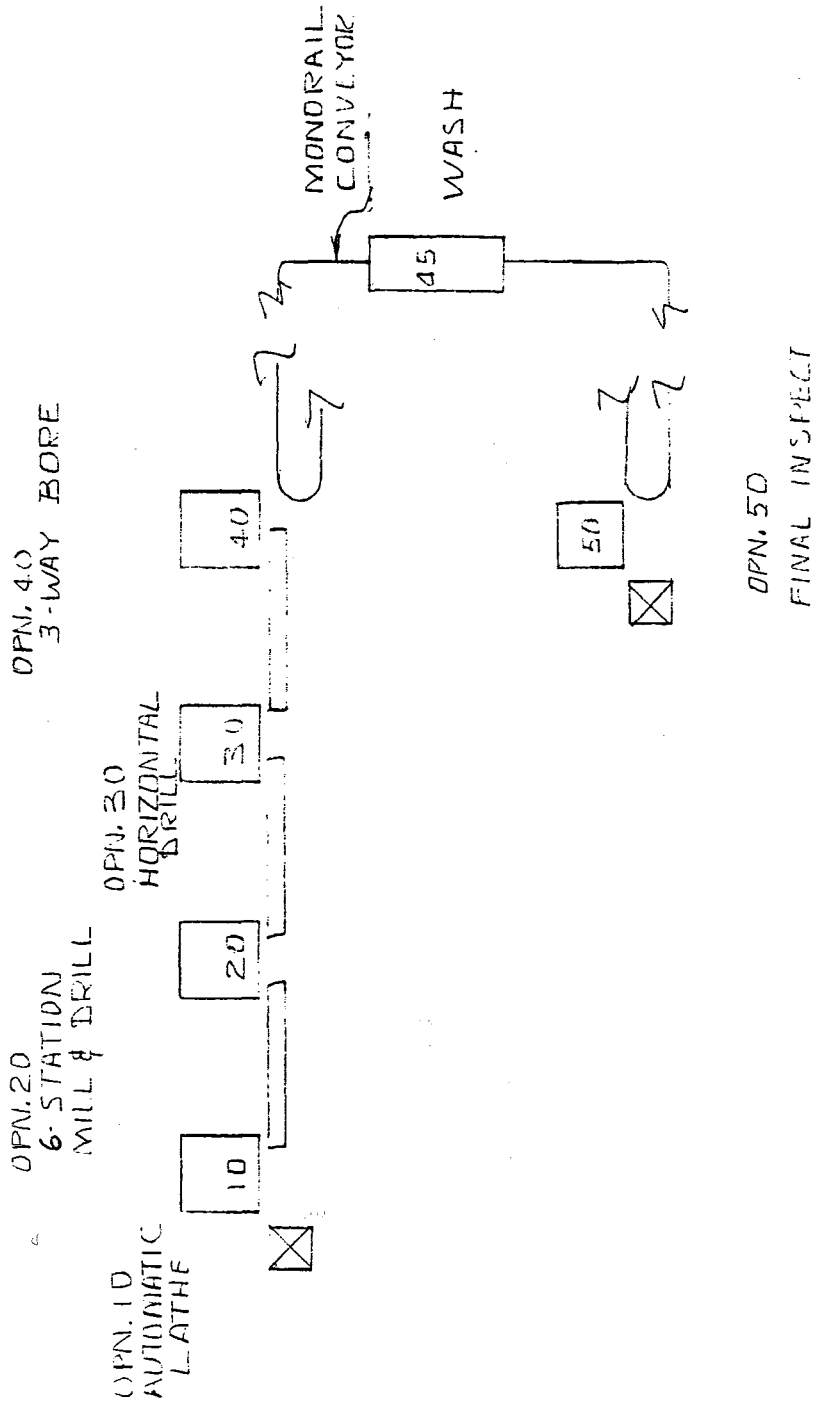
DEPARTMENT

PROGRAM OR CON NO.		PART NAME			ISSUE DATES			PART NO.						
HELIOSTAT		ATTACHMENT HOUSING			9-10-80			C-651140-46A (24)						
FOR MODELS		MATERIAL			WT./	RGH.	FIN.	RELEASE		SHEET				
ELEVATION DRIVE ASSEMBLY		PLANT ENGINEERING REQUIREMENTS			LBS.			4		4				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. COST	
1.	CHIP - COOLANT AND CLARIFICATION SYSTEMS					65,000	40,000	5,000	20,000					
2.	COOLANT REFRIGERATION SYSTEM													
3.	EXHAUST - FUME - DUST AND VENTILATION													
4.	CO <sub>2</sub> FIRE PROTECTION SYSTEM													
5.	MONORAIL CONVEYORS					80,000	40,000		4,000					
6.	MONORAIL CARRIERS (TOOLING)									10,000				
7.	ROLLER CONVEYOR					4,500	3,000		1,500					
8.	POWERED CONVEYERS													
9.	PLATFORMS - STILES													
10.	SERVICE RAILS AND HOISTS													
11.	TOOL CABINETS - RACKS AND STANDS					1,000	500		500					
12.	TOOL CONTROL CARDS													
13.	WORK - GAGING AND INSPECTION TABLES					4,000	2,000		2,000					
14.	PARTS BASKETS (EXPENSE)													5,000
15.	PRODUCTION AIDS - ASSEMBLY AIDS													
16.	SECONDARY LIGHTING													
17.	PROGRAMMABLE CONTROLLERS													
18.	AUTOMATION - PART HANDLING SYSTEM													
19.	ENGINEERING SERVICES DESIGN - (EXPENSE)													5,000
20.	BUILDING SERVICES - UTILITIES													
21.	POWER AND FREE CONVEYOR SYSTEM													
22.	POWER AND FREE CONVEYOR CARRIERS (TOOLING)													
23.	MACHINE FOUNDATIONS AND DECKS													
24.	PLANT REARRANGEMENT (EXPENSE)													
25.	MATERIALS HANDLING - RACKS - CONTAINERS - DURNAGE					2,500	2,000		500					
BUILDING CONSTRUCTION		2400 SQ. FT.												
<b>TOTALS</b>						157,000				10,000				10,000

REMARKS TOTALS: FAC. - 1,012,000 )  
 TOOLG - 349,000 ) 1,371,000  
 EXP - 10,000 )

DESIGNER	P.L.T. LAYOUT	AUTOMATION	DESIGN	FAC. ADLS. BRCA.	PLANT SERVICE	REQS. PER VEHICLE	NEXT ASSY:	SCALE

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AREA = 2400 SQ. FT.

ATTACHMENT HOUSING

C-651140-46A

PROCESS ESTIMATE SHEET

PLANT HELIXSTAT

DEPARTMENT

PROGRAM OR CCR NO.		PART NAME				ISSUE DATES			PART NO.					
FOR MODELS		ATTACHMENT HOUSING COVER				8-28-80 PROC.			WINSMITH NO. A5510L					
ELEVATION DRIVE ASSEMBLY		MATERIAL				WT./	RGH.	FIN.	RELEASE		SHEET		OF	
		10 GAGE C.R.S.				LBS.	.42		3-28-77		1		2	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TAYD/AT	
5	RECEIVE SHEET STOCK MATERIAL - TRANSFER TO PRESS SHOP. 3.5" STOCK													
10	BLANK AND PIERCE (4) 281 DIA. HOLES. DESTING OF BLANKS ATTACHED 700/HR	100 TON OBI PRESS DECOILER	1		0.11	USE FROM PRESS	RM			9,500				
20	SURFACE GRIND BOTH FACES TO .002 FLATNESS AS REQ'UTED 4.23 MINUTES/20 PIECES	NO. 11-16 BLANCHARD TYPE TOOL ROOM SURFACE GRINDER WITH MAGNETIC CHUCK	1		0.26	44,000	40,000	1,000	3,000	4,000	500	3,500		10wks
30	DEMAGNETIZE AND WASH	DEMAG COIL PARTS WASHER	1		TNC. IN MACH. CY	11,000	7,500	500	3,000					
35	FINAL INSPECT & SHIP TO ASSEMBLY	GAGE BENCH LIGHTS MISCELLANEOUS HAND GAGES MATERIAL HANDLING RACKS	1			P.E.				3,000	300	2,500		10wks
	PERSONAL RELIEF				0.02									
TOTALS														
REMARKS						(55,000)				(16,500)				
Mfg. Development		PROCESS ENGR. J. CALHOUN	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUST. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESTAN	PRODN.	50,000 PER YR.	ONE	FINAL ASSEMBLY	05-				
							DAILY PLT. PLANNING VOLUME 208	REQ'TS. 13 PC/HR. 16 HRS.	SUPERSEDES:	35				

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PLANT \_\_\_\_\_

FRUITLESS ESTIMATE SHEET

DEPARTMENT \_\_\_\_\_

25

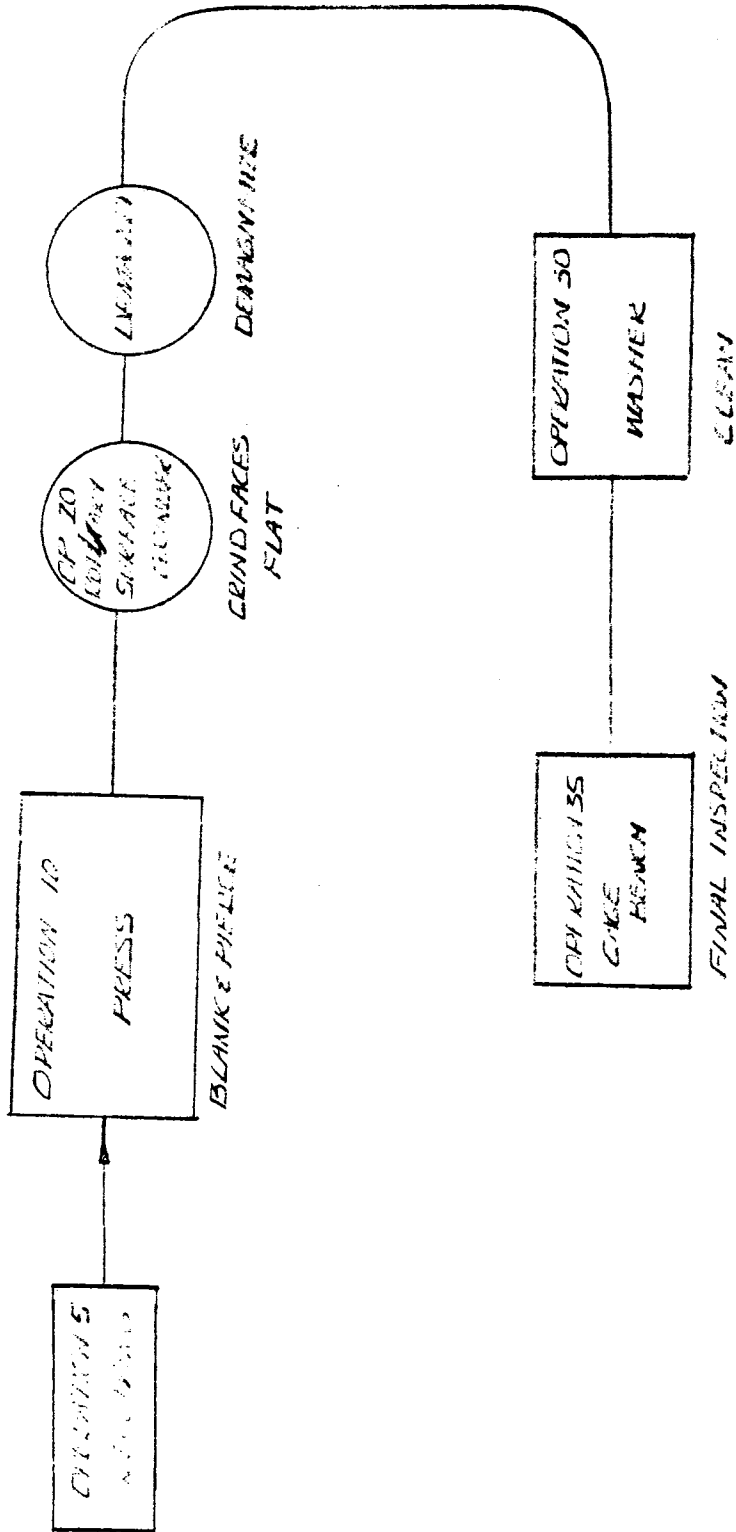
PROGRAM OR ECR NO.	PART NAME ATTACHMENT - HOUSING COVER	ISSUE DATES	PART NO. D-651140-18 DET-3
FOR MODELS ELEVATION DRIVE ASSEMBLY	MATERIAL PLANT ENGINEERING REQUIREMENTS	RT./ LBS.	RGH. FIN.
		RELEASE	SHEET 2 OF 2

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	POST. COST
1	CHHP - COOLANT AND CLARIFICATION SYSTEMS					12,500	10,000	500	2,000				
2	COOLANT REFRIGERATION SYSTEM												
3	EXHAUST - FUMES - DUST AND VENTILATION												
4	COOL FIRE PROTECTION SYSTEM												
5	MONORAIL CONVEYORS												
6	MONORAIL CARRIERS (COOLING)												
7	POWER CONVEYOR												
8	POWERED CONVEYORS												
9	PLATFORMS - STILES												
10	SCREWDRIVE RAILS AND HOISTS												
11	TOOL CABINETS - RACKS AND STANDS												
12	TOOL CONTROL BOARDS												
13	WORK - GAGING AND INSPECTION TABLES					1,000	500		500				
14	PARTS BASKETS (EXPENSE)												2,000
15	PRODUCTION AIDS - ASSEMBLY AIDS												
16	SECONDARY LIGHTING												
17	PROGRAMMABLE CONTROLLERS												
18	AUTOMATION - PART HANDLING SYSTEM	4 exp. min. \$1,000				10,000	8,000		2,000				2,000
19	ENGINEERING SERVICES DESIGN - (EXPENSE)												
20	BUILDING SERVICES - UTILITIES												
21	POWER AND FREE CONVEYOR SYSTEM												
22	POWER AND FREE CONVEYOR CARRIERS (COOLING)												
23	MACHINE FOUNDATIONS AND DECKS												
24	PLANT REARRANGEMENT (EXPENSE)												
25	MATERIALS HANDLING - RACKS - CONTAINERS - DUNNAGE												
	BUILDING CONSTRUCTION	600 SQ. FT.											
TOTALS						23,500							4,000

REMARKS TOTALS: FAC. - 78,500 )  
 TOOL. - 16,500 ) \$99,000  
 EXP. - 4,000 )

REVISIONS	PLT. LAYOUT	AUTOMATION	DESIGN	DATE MOES. ENCR.	DAILY SERVICE	REQS. PER VEHICLE	HEAT ASSY.	OPERATION
					DAILY PLT. PLANNING	INSETS	SHOWN	

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ATTACHMENT HOUSING COVER  
DG51140-B DETAIL 3  
WASHER NO. 115510 L

1 PIECE PART ASSEMBLY



PROCESS ESTIMATE SHEET

PLANT \_\_\_\_\_

DEPARTMENT \_\_\_\_\_

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PROGRAM OR ECR NO HELIOSTAT	PART NAME HIGH SPEED CAP CLOSED	ISSUE DATES 9-8-80	PART NO. A 4485 N
FOR MODELS ELEVATION DRIVE ASSEMBLY	MATERIAL CAST IRON	WT./LBS 1.21	FIN. FIN.
		RELEASE 10-7-75	SHEET 1 OF 3

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INIT. TRYOUT		
5	RECEIVE ROUGH CASTINGS				IND. LAB										
10	LOCATE ON FACE, CHUCK ON O.D., ROUGH & FINISH FACE AND TURN TWO ROUGH PASSES, ONE FINISH PASS 1.18 MIN/PC	SINGLE SPINDLE TURNING MACHINE	1	32	1.50	71,000	65,000	1000	5000	20,000					
<b>TOTALS</b>						71,000				20,000					

REMARKS \_\_\_\_\_

	PROCESS ENGR. J. Calhoun	PLT. LAYOUT	AUTOMATION	DESIGN	MATH. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.
	INDUSTRIAL ENGR. S. Lewis	LAB.	QUAL. CONTR.	PLT. ENGR. OLANESIAN	PRODN.	DAILY PLT. PLANNING VOLUME 208	ONE REQTS. 13 PC/HR. 16 HRS.	SUPERSEDES:	

*Stow* Mfg. Development  
Engrg. & Research

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**PROCESS ESTIMATE SHEET**

PROGRAM OR CTR NO. HELIOSTAT		PART NAME HIGH SPEED CAP CLOSED				ISSUE DATES 9-8-80				DEPARTMENT PART NO. H 4485N				
FOR MODELS ELEVATION DRIVE ASSEMBLY		MATERIAL CAST IRON		WT./ LBS.	QTY. 1.21	FIN.	9-8-80		RELEASE 10-7-75	SHEET 2	OF 3	(2)		
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD		INST. TRYOUT
20	CHUCK O.D. LOCATE RADIALY, DRILL 4 HOLES .281 DIA. SPOTFACE .50 MIN/PC	DRILL PRESS MULTISPINDLE HEAD	1	76	.63	27,500	25,000	500	2000	6,000				
25	WASH	AVAILABLE			INC. IN CYCLE									
30	INSPECT	GAGE BENCH			IND. LAB					2,000				
	PERSONAL RELIEF				.14									
<b>TOTALS</b>					2.27	27,500				8,000				
REMARKS														
PROCESS ENGR. J. CALHOUN		PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR. OHANESIAN	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME 208	REQ'D. PER VEHICLE ONE	REMTS. 13 PC/NR. 16 HRS.	NEXT ASSY: SUPERSEDES:	OPER. NO.				
Mfg. Development Engrg. & Research														

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PLANT

D-651140-18 DETAIL 4

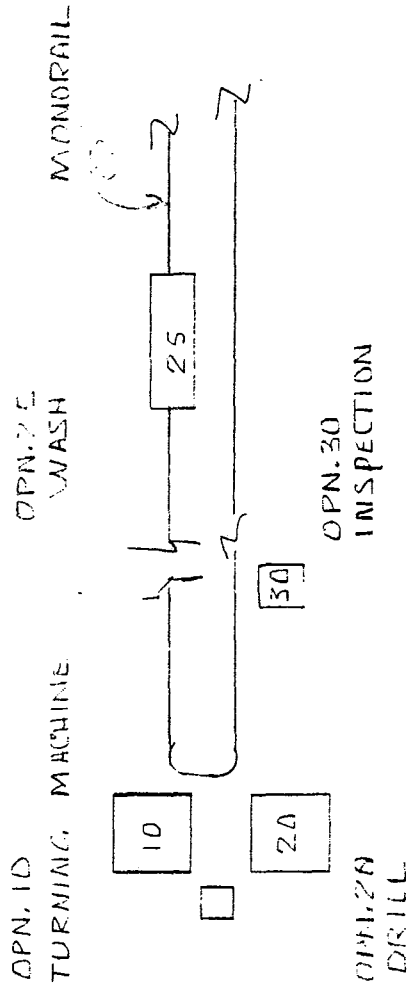
PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR CTR NO. HELIOSTAT		PART NAME HIGH SPEED CAP CLOSED			ISSUE DATES 9-9-80				PART NO. A-4485N					
FOR MODELS ELEVATION DRIVE ASSEMBLY		MATERIAL PLANT ENGINEERING REQUIREMENTS			WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 3 OF 3				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACHS. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
1	CHIP-COOLANT AND CLARIFICATION SYSTEMS					15,500	10,000	500	5,000					
2	COOLANT REFRIGERATION SYSTEM													
3	EXHAUST - FUME - DUST AND VENTILATION													
4	CO <sub>2</sub> FIRE PROTECTION SYSTEM													
5	MONORAIL CONVEYORS													
6	MONORAIL CARRIERS (TOOLING)													
7	ROLLER CONVEYOR					3,000	1,500		1,500					
8	POWERED CONVEYORS													
9	PLATFORMS - STILES													
10	SERVICE RAILS AND HOLSTS													
11	TOOL CABINETS - RACKS AND STANDS					1,000	500		500					
12	TOOL CONTROL BOARDS													
13	WORK - GAGING AND INSPECTION TABLES					2,000	1,000		1,000					
14	PARTS BASKETS (EXPENSE)													1,000
15	PRODUCTION AIDS - ASSEMBLY AIDS													
16	SECONDARY LIGHTING													
17	PROGRAMMABLE CONTROLLERS													
18	AUTOMATION - PART HANDLING SYSTEM													
19	ENGINEERING SERVICES DESIGN (EXPENSE)													1,000
20	BUILDING SERVICES - UTILITIES													
21	POWER AND FREE CONVEYOR SYSTEM													
22	POWER AND FREE CONVEYOR CARRIERS (TOOLING)													
23	MACHINE FOUNDATION AND DECKS													
24	PLANT REARRANGEMENT (EXPENSE)													
25	MATERIALS HANDLING - RACKS - CONTAINERS - DUNNAGE					1,500	1,000		500					
	TILT RACK STD													
	BUILDING CONSTRUCTION	500 SQ. FT.				23,000								2,000
<b>TOTALS</b> REMARKS: TOTALS: FAC - 121,500 TOOLS - 28,000 } = \$151,500 EXP - 2,000														
Mfg. Development Engrg. & Research		PROJ. ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODM.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:					

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SQUARE FEET- 500

HIGH SPEED CAP CLOSED  
651140-125 - DETAIL 4  
A 1485-N

PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO.		PART NAME				ISSUE DATES			DEPARTMENT						
FOR MODELS		MATERIAL				WT./	RGH.	FIN.	PART NO.						
ELEVATION DRIVE ASSEMBLY		CAST IRON (MECHANITE)				LBS.	4.2#		8-29-80 PROC.		WINSMITH NO. B651140-20				
						NO PRINT			RELEASE		SHEET OF				
						NO PRINT			NO PRINT		1 3				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRVQ/23		
5	RECEIVE ROUGH CASTINGS CHECK INVENTORY BY WEIGHT- INSPECT FOR HARDNESS	UNLOAD FACILITIES INDUSTRIAL SCALE BENCH BRINELL HARDNESS TESTOR													
10	LOCATE ON FACE. CHECK ON SMALL O.D.-ROUGH & FINISH FACE & TURN MIDDLE O.D. ROUGH & FINISH BORE AND FACE BEARING POCKET, & ROUGH & FINISH BORE SHAFT I.D. MACH. CYC. TIME=2.59 MIN/2PC 1 MAN 1 MACHINE	CAM CONTROLLED BORE AND TURNING MACHINE NEW BRITAIN DEARBORN OLOPSSON DRY TWO SPINDLE	1	28	1.71	77,000	70,000	1,000	6,000	30,000					
TOTALS															
REMARKS						NO PART PRINT AVAILABLE AT TIME OF PROCESS.		77,000		30,000					
Mfg. Development Engrg. & Research		PROCESS ENGR. J. CALHOUN	PLT. LAYOUT LAB.	AUTOMATION	DESIGN OHANESTAN	MATL. MDLG. ENGR.	PRODM.	DAILY SERVICE 50,000 PER YR.	REQ'D. PER VEHICLE ONE	NEXT ASSY: FINAL ASSY.	OPER. NO. 5				
		INDUSTR. ENGR. S. LEWIS		QUAL. CONTR.				DAILY PLY. PLANNING VOLUME 208	REQ'TS. 13 PC/HR.	SUPERSEDES: 16 HRS.	OPER. NO. 10				

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PROCESS ESTIMATE SHEET

PROGRAM OR CER NO.		PART NAME				ISSUE DATES				DEPARTMENT				
FOR MODELS		MATERIAL				WT./	RGH.	FM.	PART NO.					
ELEVATION DRIVE ASSEMBLY		CAST IRON				LBS.	4.2		WINSMITH NO B651140-20					
						8-29-80				RELEASE		SHEET 2 OF 3		
										NO PRINT				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	EXPENSE COST
20	LOCATE PART IN ID. POSITION BUSHING PLATE - DRILL 6 BOLT CLEARANCE HOLES MCT=2.38 MIN/PC. 25 PC/HR GROSS	SINGLE SPINDLE H.D. DRILL PRESS - MORSE TAPER SPINDLE	1	16	3.00	22,000	20,000	500	1,500	1,500	200	1,300		
	WASH					AVAILABLE								
25	INSPECT & MOVE TO ASSEMBLY	GAGES BENCH STOCK RACKS								1,000				
	PERSONAL RELIEF				0.32									
TOTALS					5.03	22,000				2,500				
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR. J. CALHOUN	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTRIAL ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	50,000 PER YR. DAILY PLT. PLANNING VOLUME 208	ONE REQMTS. 13 PC/HR. 16 HRS.	FINAL ASSEMBLY SUPERSEDES:	20				25

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PROCESS ESTIMATE SHEET

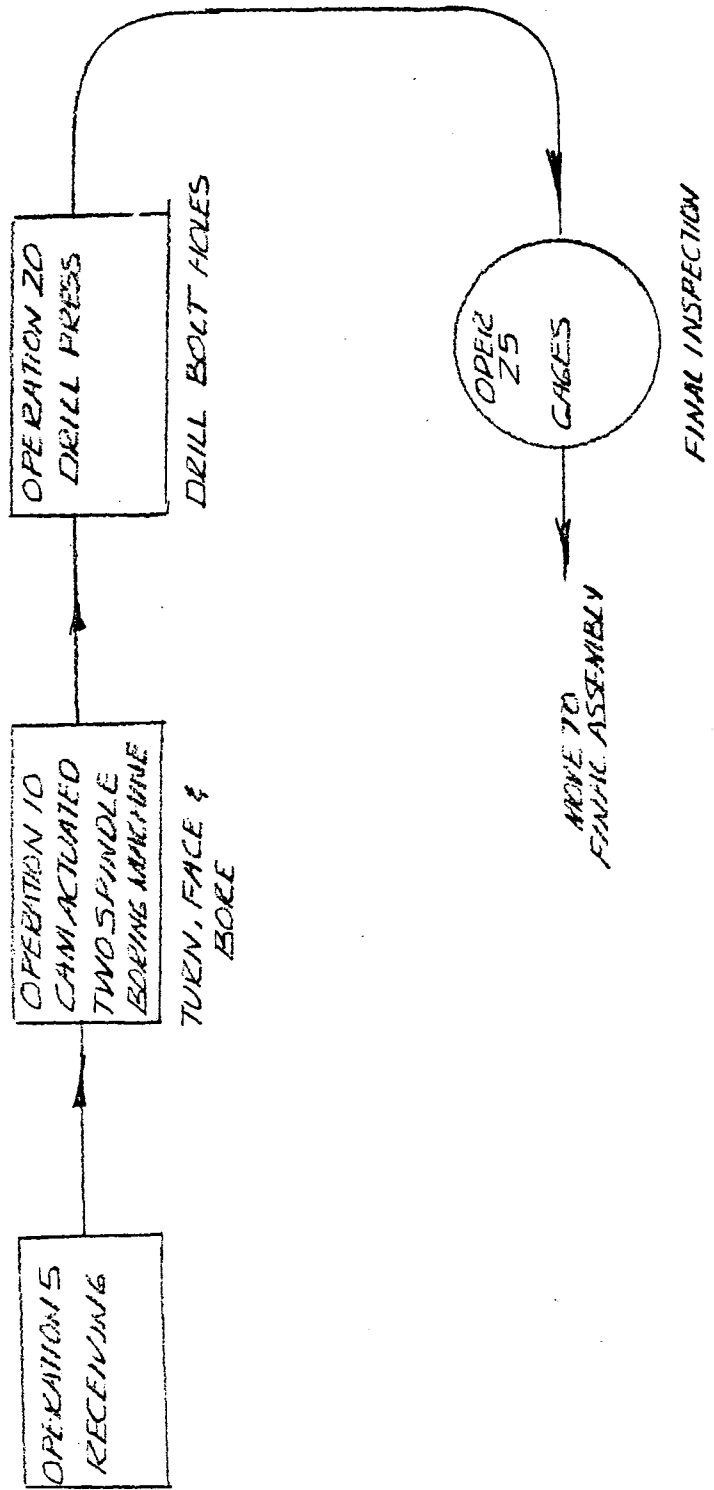
PROGRAM OR CCR NO.		PART NAME			ISSUE DATES			DEPARTMENT							
FORD AEROSPACE		S.S. COVER						B651140-20 - SKETCH							
FOR MODELS		MATERIAL			WT./	RGH.	FM.	RELEASE		SHEET 3 OF 3					
HILTIOSAT - ELEVATION DRIVE ASSEMBLY		PLANT ENGINEERING REQUIREMENTS			LBS										
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'T SEQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. BYCOST		
1	CHIP - COOLANT AND CLARIFICATION SYSTEMS					12,500	10,000	500	2,000						
2	COOLANT REFRIGERATION SYSTEM														
3	EXHAUST - FUME - DUST AND VENTILATION														
4	CO2 FIRE PROTECTION SYSTEM														
5	MONORAIL CONVEYORS														
6	MONORAIL CARRIERS (TOOLING)														
7	ROLLER CONVEYOR					1,000	500		500						
8	POWERED CONVEYORS														
9	PLATFORMS - STILES														
10	SERVICE RAILS AND HOISTS								500						
11	TOOL CABINETS - RACKS AND STANDS					500			500						
12	TOOL CONTROL BOARDS														
13	WORK - GAGING AND INSPECTION TABLES					1,000	500		500						
14	PARTS BASKETS (EXPENSE)														2,000
15	PRODUCTION AIDS - ASSEMBLY AIDS														
16	SECONDARY LIGHTING														
17	PROGRAMMABLE CONTROLLERS														
18	AUTOMATION - PART HANDLING SYSTEM														
19	ENGINEERING SERVICES DESIGN - (EXPENSE)														2,000
20	BUILDING SERVICES - UTILITIES														
21	POWER AND FREE CONVEYOR SYSTEM														
22	POWER AND FREE CONVEYOR CARRIERS (TOOLING)														
23	MACHINE FOUNDATIONS AND DECKS														
24	PLANT REARRANGEMENT (EXPENSE)														
25	MATERIALS HANDLING - RACKS - CONTAINERS - DUNNAGE														
	BUILDING CONSTRUCTION					800 SQ. FT.									
<b>TOTALS</b>															
<b>REMARKS</b>						TOTALS: FAC. - 114,000 )				15,000				4,000	
						TOOLG - 32,500 )150,500									
						EXP - 4,000 )									
		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
		INDUST. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTL. PC/HR.	SUPERSEDES: HRS.						

Mfg. Development  
Engrg. & Research

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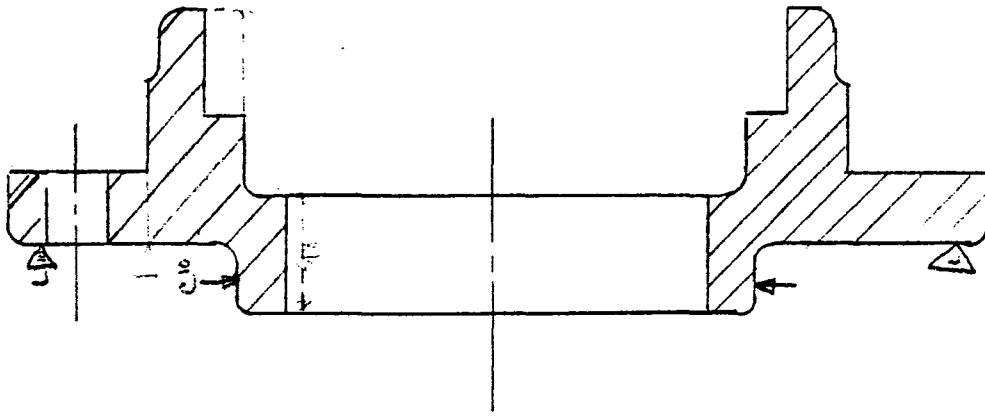
OPERATION LINE FLOW FOR  
S.S. COVER  
DESIGN-18 DETAIL 5  
W/INSMITH DRAWING BES/140-20





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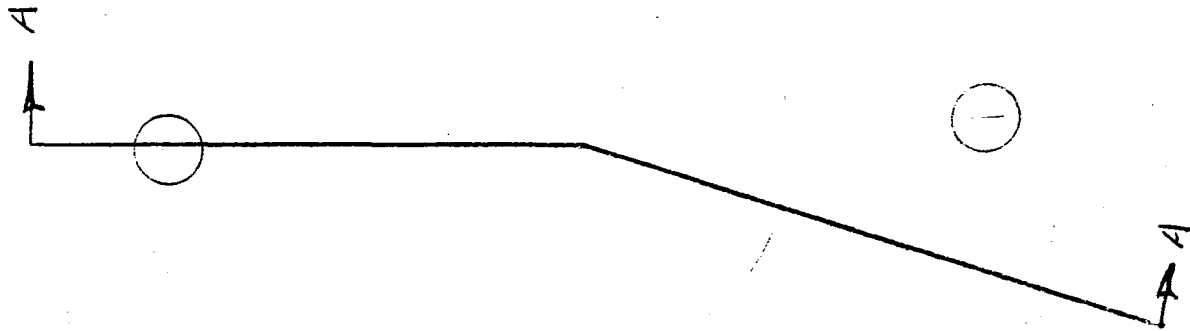
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SKETCH OF DETAIL 5  
 D651140-18

WARRANTY NO B651140-20

S.S. COVER



53 O.D  
 2.25 I.D

WT EST 2 4.154 LBS  
 VOLUME 2 15.975 CUIN

DETAIL 6

PROCESS ESTIMATE SHEET

DEPARTMENT: STEEL MACHINING

PROGRAM OR CEN NO.		PART NAME				ISSUE DATES				PART NO.				
FOR MODELS ELEVATION DRIVE ASSEMBLY		HIGH SPEED CAP - OPEN				8-29-80 PROC. 4-7-80 DESIGN				WINSMITH NO. A651140-45A				
		MATERIAL C1117 COLD ROLL STEEL				WT./ LBS. 1,344				RELEASE 4-7-80				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'N REQS.	NET HOURLY CAP.	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALL- LATION	TOTAL	DESIGN	BUILD	INST. TRY/CS	
5	RECEIVE BAR STOCK 20FT LENGTHS	CRANE												
10	CHUCK ON BAR O.D. & PERFORM THE FOLLOWING: ROUGH-FACES CENTER DRILL PILOT DRILL BORE DRILL 1" ID COUNTER BORE CUTOFF MACHINE CYCLE TIME 1.51 MIN/PC 1.5 HR CHANGE OVER	5" TURRET LATHE AIR LOGIC CIRCUITS	1	25	1.94	92,000	84,000	1,000	7,000	7,000				
<b>TOTALS</b>						92,000				7,000				
<b>REMARKS</b>														
Mfg. Development Engrg. & Research		PROCESS ENGR. J. CALHOUN	PLY. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE 50,000 PER YR	REQ'D. PER VEHICLE ONE	NEXT ASSY: ASSEMBLY	OPER. NO. 5				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLY. ENGR. OHANESIAN	PRODN.	DAILY PLY. PLANNING VOLUME 208	REQMTS. 13 PC/HR. 16 HRS.	SUPERSEDES:	10				

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PROCESS ESTIMATE SHEET

PLANT _____		DEPARTMENT: STEEL MACHINING												
PROGRAM OR ECR NO.		PART NAME HIGH SPEED CAP-OPEN				ISSUE DATES 8-29-80 PROC. 4-7-80 DES.		PART NO. SINSMITH NO. A651140-45A						
FOR MODELS ELEVATION DRIVE ASSEMBLY		MATERIAL C1117 STEEL		WT./ LBS.	RGH. 1.344	FM.	RELEASE 4-7-80	SHEET 2 OF 4						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR D.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
20	CHUCK ON O.D. FINISH FACE SURFACE 'A' & FINISH TURN 1.572 DIA. SECOND CHUCKING. LOCATE ON SURFACE 'A' CHUCK ON O.D. FINISH FACE, TURN & BORE I.D. MCT-1.00	2 STATION BORING MACHINE	1	38	1.26	79,000	72,000	1,000	6,000	33,000	5,000	28,000		
TOTALS						79,000				33,000				
REMARKS														
PROCESS ENGR. J. CALHOUN		PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PRODM.	QAMM SERVICE 50,000 PER YR	REQ'D. PER VEHICLE ONE	NEXT ASSY: FINAL ASSEMBLY		OPER. NO.				
INDUSTRIAL ENGR.						DAILY PLT. PLANNING VOLUME 208	REQMTS. 13 PC/HR.	16 HRS.		SUPERSEDES:				

*Ford* Mfg. Development  
Engrg. & Research

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DETAIL 6

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PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO.		PART NAME			ISSUE DATES		DEPARTMENT: STEEL MACHINING								
ELEVATION DRIVE ASSEMBLY		HIGH SPEED CAP - OPEN			8-29-80		PART NO. WINSMITH NO. A651140-45A								
		MATERIAL C1117 STEEL			WT./LBS.	RGH. FM.	RELEASE 4-7-80		SHEET 3 OF 4						
							4-7-80								
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				SUPERSEDE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRYG/AT		
30	DRILL FOUR .281 DIA. BOLT HOLES- DRILL ONE HOLE AT A TIME USING DRILL FIXT. & CENTER PART VIA ID. MCT=.75 MIN/PC	PRODUCTION DRILL PRESS	1	51	0.94	USE EXISTING DRILL ON DETAILS					3,000	500	2,500		
	WASH					AVAILABLE									
35	FINAL INSPECTION	GAGES BENCH LIGHTS			IND. LAB	1,000			1,000	6,000	600	5,400			
	PERSONAL RELIEF				0.2P										
TOTALS					4.42										
REMARKS						1,000				9,000					
		PROCESS ENGR. J. CALHOUN	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE 50,000 PER YR.	REQ'D. PER VEHICLE ONE	NEXT ASSY: FINAL ASSY.	OPER. NO. 30					
		INDUSYR. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME 208	REQMTS. 13 PC/HR. 16 HRS.	SUPERSEDES:	OPER. NO. 35					

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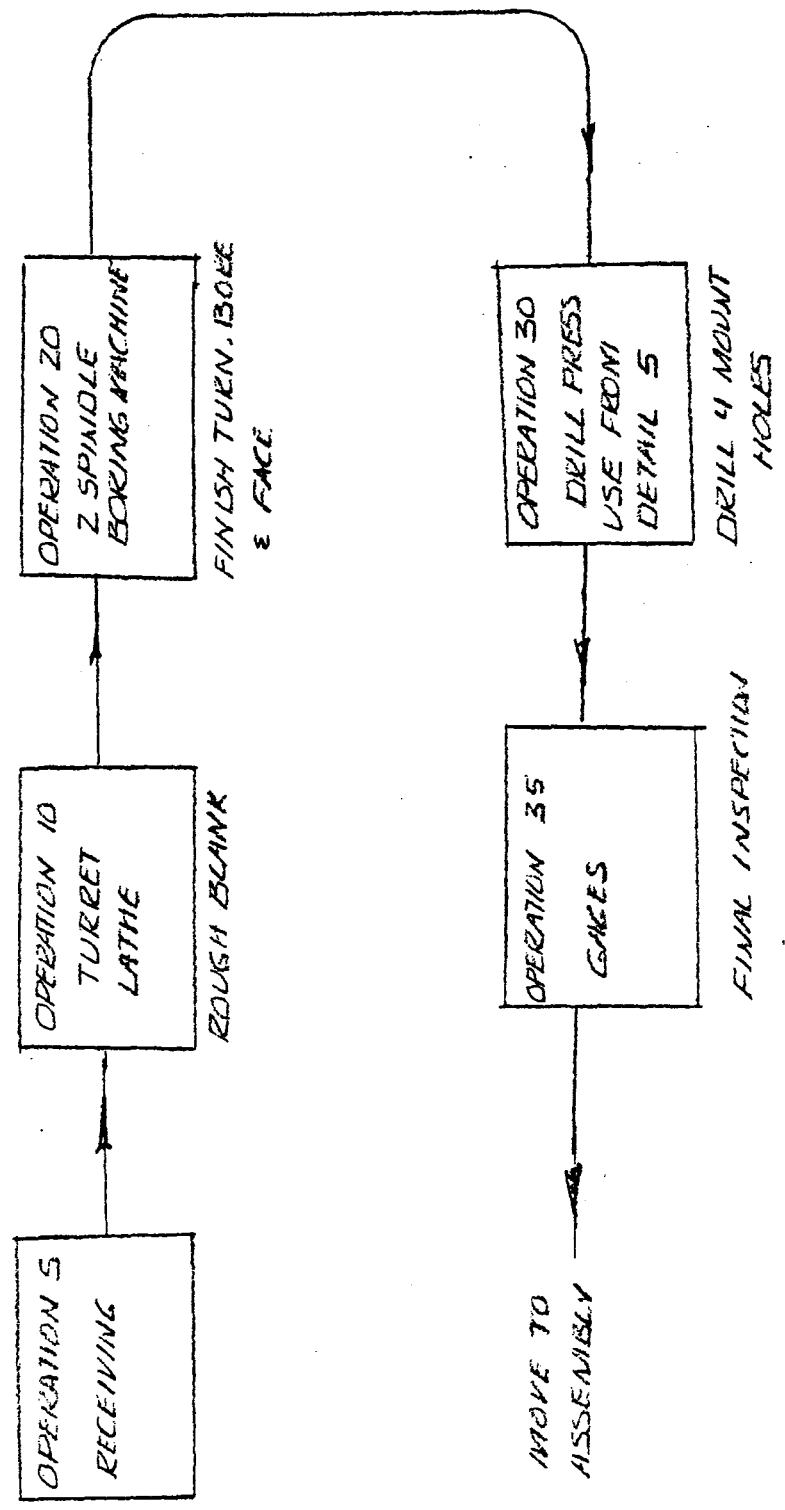
Mfg. Development  
Engr. & Research

PROCESS ESTIMATE SHEET

PLANT		PROGRAM OR ECR NO.					PART NAME				ISSUE DATES				DEPARTMENT			
		HIGH SPEED CAP - OPEN									PART NO.							
FOR MODELS		MATERIAL					WT./ RGN. FMS.				A651140-45A - DET. 6							
ELEVATION DRIVE ASSEMBLY		PLANT ENGINEERING REQUIREMENTS					LBS.				RELEASE SHEET 4 OF 4							
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				DEPEND. COST				
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYS/CT					
1	CHIP - COOLANT AND CLARIFICATION SYSTEMS					12,500	10,000	500	2,000									
2	COOLANT REFRIGERATION SYSTEM																	
3	EXHAUST - FUME - DUST AND VENTILATION																	
4	CO2 FIRE PROTECTION SYSTEM																	
5	MONORAIL CONVEYORS																	
6	MONORAIL CARRIERS (TOOLING)																	
7	ROLLER CONVEYOR					1,000	500		500									
8	POWERED CONVEYORS																	
9	PLATFORMS - STILES																	
10	SERVICE RAILS AND HOISTS																	
11	TOOL CABINETS - RACKS AND STANDS																	
12	TOOL CONTROL BOARDS																	
13	WORK - GAGING AND INSPECTION TABLES					1,000	500		500									
14	PARTS BASKETS (EXPENSE)													2,000				
15	PRODUCTION AIDS - ASSEMBLY AIDS																	
16	SECONDARY LIGHTING																	
17	PROGRAMMABLE CONTROLLERS																	
18	AUTOMATION - PART HANDLING SYSTEM																	
19	ENGINEERING SERVICES DESIGN - (EXPENSE)													2,000				
20	BUILDING SERVICES - UTILITIES																	
21	POWER AND FREE CONVEYOR SYSTEM																	
22	POWER AND FREE CONVEYOR CARRIERS (TOOLING)																	
23	MACHINE FOUNDATIONS AND DECKS																	
24	PLANT REARRANGEMENT (EXPENSE)																	
25	MATERIALS HANDLING - RACKS - CONTAINERS - DUNNAGE																	
BUILDING CONSTRUCTION		800 SQ. FT.																
TOTALS																		
REMARKS TOTALS: FAC. - 186,500 )						14,500				4,000								
TOOLG - 49,000 ) 239,500																		
EXP. - 4,000 )																		
		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.								
Mfg. Development Engrg. & Research		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	ACCTS.	SUPERSEDES:									
								PC/NR.	MRS.									

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PRODUCTION LAYOUT  
HIGH SPEED CAP-OPEN  
D651140-18 DETAIL 6  
WINSMITH NO. A651140-45A



800 Sq. Ft.

PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO. HELIOSTAT		PART NAME STANDARD MOTOR ADAPTER				ISSUE DATES 9-8-80		DEPARTMENT PART NO. C7922A							
FOR MODEL'S ELEVATION DRIVE ASSEMBLY		MATERIAL CAST IRON		WT./ LBS.	RGH. 8.3	FIN.	RELEASE 6-20-75		SHEET 1 OF 1						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQ.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL- LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
05	RECEIVE CASTING														
10	ROUGH AND FIN. BOTTOM SURFACE AND 4 .5005/4.5025 C'BORE	AUTO. CYCLE TURRET LATHE	1	30	1.62	99,000	90,000	2,000	7,000	20,000					
		GAGES								3,000					
	EST. F. TOP - 1.3 MIN.														
20	CORE DRILL AND FIN. BORE 1.124 BORE R. & F. TURN; 1.574 O.D. and ADJ. SURFACE.	FROM OPER. 10		30	1.62					15,000					
	EST. F. TOP - 1.3 MIN.	GAGES								6,000					
	EST. CHANGE-OVER (2) HOURS														
TOTALS						99,000				44,000					
REMARKS TOOLING FOR MOTOR ADAPTER ON AZIMUTH DRIVE 13,400, USE SAME FACILITIES.															
PROCESS ENGR. H. GOVE		PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE 100,000 PER YR.	REQ'D. PER VEHICLE 2	NEXT ASSY:		OPER. NO.					
INDUSTR. ENGR.		LAB.	QUAL. CONTR.	PLT. ENGR. OHANESIAN	PROD.	DAILY PLT. PLANNING VOLUME 416 PER DAY	REQMTS. 26 PC/HR. 16 HRS.	SUPERSEDES:							

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**PROCESS ESTIMATE SHEET**

PLANT _____		<b>PROCESS ESTIMATE SHEET</b>						DEPARTMENT _____						
PROGRAM OR ECR NO.		PART NAME STANDARD MOTOR ADAPTER				ISSUE DATES		PART NO. C7922A						
FOR MODELS ELEVATION DRIVE ASSEMBLY		MATERIAL			WT./ LBS.	RGH.	FIN.	9-8-80		RELEASE	SHEET 2 OF 3			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQS.	NET HOURLY CAP.	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD		INST. TRVQZ
30	DRILL (4) .406 DIA. HOLES	VERT. DRILL PRESS W/MULT. SPDR.	1	64	.75	33,500	30000	500	3000	10,000				
	EST. F. TO F. - .60 MIN.	GAGES								2,000				
40	DRILL (4) .281 DIA. HOLES	FROM OPER. 30	-	51	.94					2,000				
	EST. F. TO F. - .75 MIN.	GAGES								1,000				
	EST. CHANGE-OVER (2) HOURS													
50	<del>DRILL AND TAP</del> DRILL AND TAP 3/8-18 N.P.T.	VERT. DRILL PRESS (AVAIL. TIME)	-	38	1.25					8,000				
	EST. F. TO F. - 1.0 MIN.													
60	WASH	AVAIL.												
70	FINAL INSPECT AND TRANSPORT TO GEAR ASSEMBLY													
	PERSONAL RELIEF				.41									
<b>TOTALS</b>						6.59	33,500			23,000				
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR. H. G.	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. HDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME	REQ'D. PER VEHICLE PC/HR.	REQMYS. HRS.	NEXT ASSY: SUPERSEDES:	OPER. NO.			

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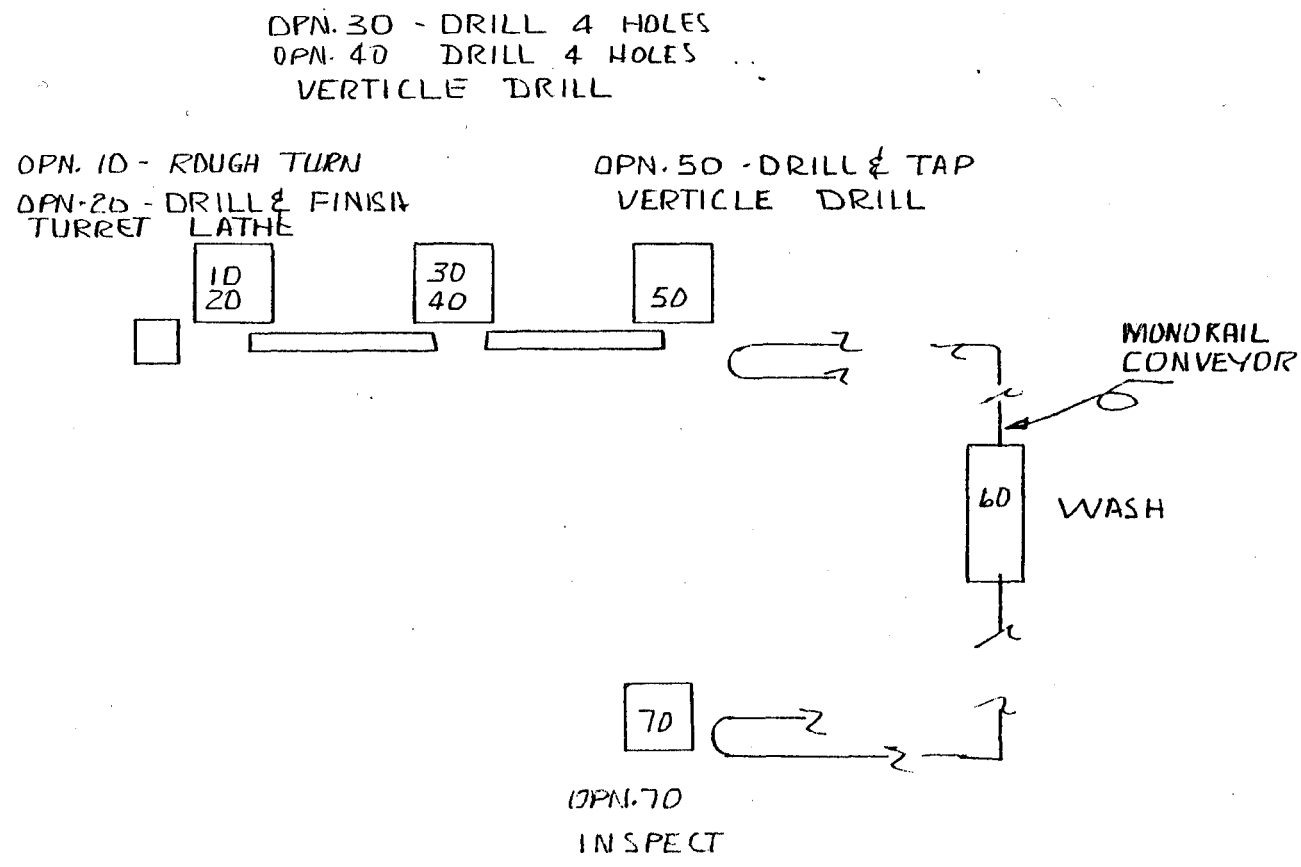


PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO. HELIOSTAT		PART NAME STANDARD MOTOR ADAPTER				ISSUE DATES 9-12-80		DEPARTMENT: PART NO. C-7922A						
FOR MODELS ELEVATION DRIVE ASSEMBLY		MATERIAL PLANT ENGINEERING REQUIREMENTS		WT./ LBS.	RGH.	FIN.	RELEASE	SHEET 3 OF 3						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD		INST. TRYOUT
1.	CHIP - COOLANT AND CLARIFICATION SYSTEMS					31,000	20,000	1,000	10,000					
2.	COOLANT REFRIGERATION SYSTEM													
3.	EXHAUST - FUME - DUST AND VENTILATION													
4.	CO <sub>2</sub> FIRE PROTECTION SYSTEM													
5.	MONORAIL CONVEYORS					10,000	5,000		5,000					
6.	MONORAIL CARRIERS (TOOLING)									3,000				
7.	ROLLER CONVEYOR					1,000	500		500					
8.	POWERED CONVEYORS													
9.	PLATFORMS - STILES													
10.	SKEIVE PAILS AND HOISTS													
11.	TOOL CABINETS - RACKS AND STANDS					500	500							
12.	TOOL CONTROL BOARDS													
13.	WORK - GAGING AND INSPECTION TABLES					1,000	500		500					
14.	PARTS BASKETS (EXPENSE)													3,000
15.	PRODUCTION AIDS - ASSEMBLY AIDS													
16.	SECONDARY LIGHTING													
17.	PROGRAMMABLE CONTROLLERS													
18.	AUTOMATION - PART HANDLING SYSTEM													
19.	ENGINEERING SERVICES DESIGN - (EXPENSE)													2,000
20.	BUILDING SERVICES - UTILITIES													
21.	POWER AND FREE CONVEYOR SYSTEM													
22.	POWER AND FREE CONVEYOR CARRIERS (TOOLING)													
23.	MACHINE FOUNDATIONS AND DECKS													
24.	PLANT REARRANGEMENT (EXPENSE)													
25.	MATERIALS HANDLING - RACKS - CONTAINERS - DUNNAGE					2,000	1,500		500					
BUILDING CONSTRUCTION		800 SQ. FEET				45,500				3,000				5,000
TOTALS						45,500				3,000				5,000
REMARKS						TOTALS: FAC. 178,000 } = 253,000 TOOLING 79,000								
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTRIAL ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:					

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AREA - 800 SQ. FT.  
STANDARD MOTOR ADAPTER  
C-7922 A

PROCESS ESTIMATE SHEET

PLANT

DEPARTMENT

PROGRAM OR ECR NO.		PART NAME S.S. SHAFT			ISSUE DATES 4/1/80		PART NO. B-651140-23							
FOR MODEL ELEVATION DRIVE ASSEMBLY		MATERIAL 304 - STAINLESS STEEL			WT./LBS. 33.9 LBS		FIN.		RELEASE	SHEET 1 OF 6				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. SECS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRNG/23	
	MATERIAL = 304 STAINLESS STEEL BAR	STOCK												
	BAR = 17' - 0" LONG X 1.5" DIA	FINISHED TO SIZE.												
10	CUT OFF TO PART	ABRASIVE CUT OFF	1	96	0.50	99000	90,000	2000	7000	10,000				
	LENGTH = 67.70 IN. LONG	MACHINE												
		MAGAZINE BAR	1			13000	12000	1000	2000	2000				
		FEED												
		HOIST												
20	FACE, CHAMFER AND	DOUBLE END FACE	1	48	1.00	104,000	95,000	2000	7000	15,000				
	CENTER BOTH ENDS	AND CENTER												
	OF SHAFT	MACHINE												
TOTALS						216,000				27,000				
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR. OHANESIAN	PLT. LAYOUT LAB.	AUTOMATION QVAL. CONTR.	DESIGN PLT. ENGR. OHANESIAN	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME 208	REQ'D. PER VEHICLE 1	RENTS. 13 PC/HR. 16 HRS.	NEXT ASSY: SUPERSEDES:	OPER. NO.			

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PLANT \_\_\_\_\_ D651140-18 DETAIL B

**PROCESS ESTIMATE SHEET**

DEPARTMENT \_\_\_\_\_

PROGRAM OR CTR NO.	PART NAME S.S. SHAFT	ISSUE DATES 4/1/80	DEPARTMENT
FOR MODELS ELEVATION DRIVE ASSEMBLY	MATERIAL 304 STAINLESS STEEL	WT./ LBS.    RGH.    FWH.	PART NO. B-651140-73
			RELEASE      SHEET 2 OF 6

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD		INST. TRVCT
50	ROUGH MILL 1-1/2" X 4 ACME THREAD	THREAD MILL WITH CARBIDE CUTTER 68 MINUTES CYCLE TIME FOR ONE PASS. (1) MAN (15) MACHINES (1) MACH. SETTER	23	16	3.00	4,975,000	4,531,000	69,000	375,000	230,000				
<i>(197,000 + 10,000 Tool Build 207,000 x 23)</i>														
<b>TOTALS</b>						4,975,000				230,000				

REMARKS: *See Revised Sketch*

	PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASBY:	OPER. NO.
Mfg. Development Engrg. & Research	INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQNTS. PC/HR.    HRS.	SUPERSEDED:	

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PLANT

D651140-18 DETAIL 8

PROCESS ESTIMATE SHEET

DEPARTMENT:

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PROGRAM OR EEA NO.	PART NAME S.S. SHAFT	ISSUE DATES 4/1/80	PART NO. B-651140-23
FOR MODEL ELEVATION DRIVE ASSEMBLY	MATERIAL 304 STAINLESS STEEL	WT./ LBS.	RELEASE SHEET 3 OF 6

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRVCT	
60	PLACE SHAFT INTO STORAGE RACKS AND STORE FOR 4 DAYS AT ROOM TEMPERATURE TO STRESS RELIEVE.	MATERIAL HANDLING STORAGE RACKS			IND LAB									
70	FINISH MILL 1 1/2 X 4 ACME THREAD (2nd PASS)	THREAD MILL WITH CARBIDE CUTTER	23	16	3.00	4,975,000	<del>69,000</del>	<del>173,000</del>	<del>375,000</del>	230,000				
		68 MINUTES CYCLE TIME (1) MAN. (15) MACHINES (1) MACHINE SETTER												
TOTALS						4,975,000			<del>230,000</del>	230,000				

REMARKS

PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.
INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/NR. NRS.	SUPERSEDES:	

*Ford* Mfg. Development  
Engr. & Research

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D651140-18 DETAIL-B

PROCESS ESTIMATE SHEET

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PROGRAM OR ECR NO.		PART NAME				ISSUE DATES				DEPARTMENT				
FOR MODELS		MATERIAL				WT./				PART NO.				
ELEVATION DRIVE ASSEMBLY		304 STAINLESS STEEL				RGH. FIM.				B-651140-23				
						4/1/80				RELEASE SHEET 6 OF 6				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYS/MT	
80	DRILL & TAP BOTH ENDS MILL KEYWAY	SHUTTLE TYPE INDEX MACHINE	1	48	1.00	192,000	175,000	2,000	15,000	50,000				
TOTALS						192,000				50,000				
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	RECHYS. PC/HR. HRS.	SUPERSEDES:					

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PLANT \_\_\_\_\_

D651140-18 Det: 1 8

PROCESS ESTIMATE SHEET

DEPARTMENT \_\_\_\_\_

PROGRAM OR ECR NO.		PART NAME			ISSUE DATES			PART NO.							
ELEVATION DRIVE ASSEMBLY		S.S. SHAFT			4/1/80			8651140-23							
FOR MODELS		MATERIAL			WT./RGH. FIN.			RELEASE		SHEET 5 OF 6					
		304 STAINLESS STEEL			LBS.										
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'N REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. BY COST		
90	WASH SHAFT, VISUAL INSPECT AND DEBURR	WASHER MONORAIL	1	16	3.00	AVAILABLE IN STEEL MACHINING AREA									
100	FINAL INSPECTION 100% ALL PRINT DIMENTIONS	VISUAL AND LEAD CHECKER & MANUAL GAGES	2	12	IND. LAB	27,000	20,000	2,000	5,000	100,000					
					15.50										
	PERSONAL RELIEF				1.05										
TOTALS					16.65	27,000				100,000					
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE		NEXT ASSY:		OPER. NO.			
		INDUSTRIAL ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS.	PC/HR.	HRS.	SUPERSEDES:				

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**PROCESS ESTIMATE SHEET**

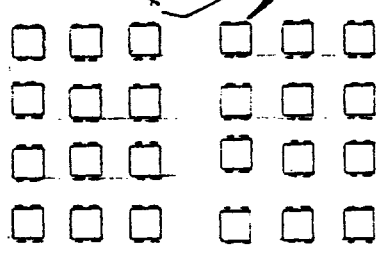
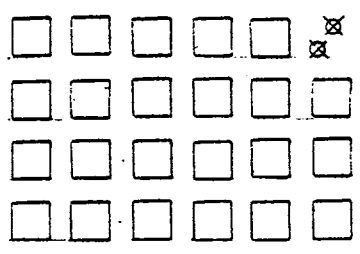
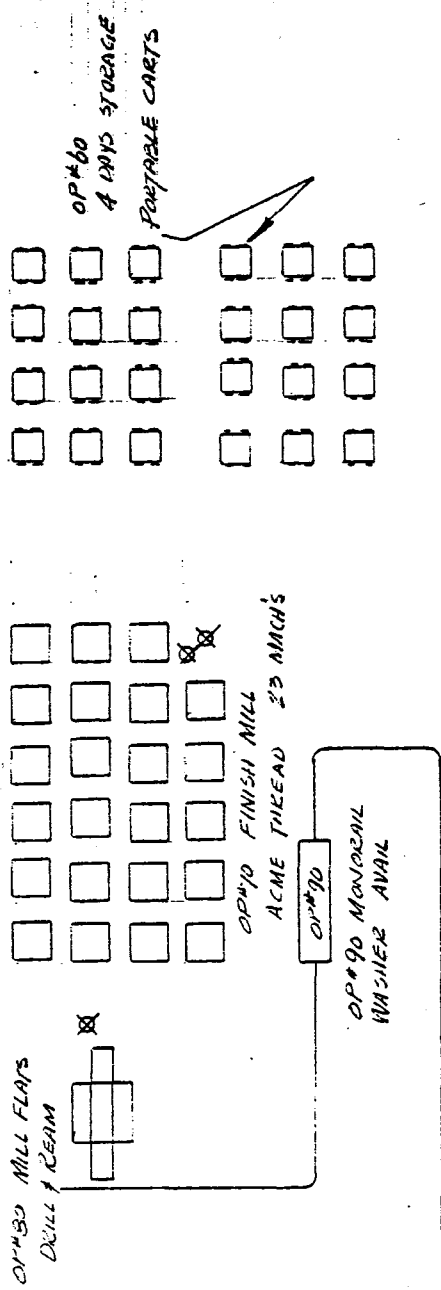
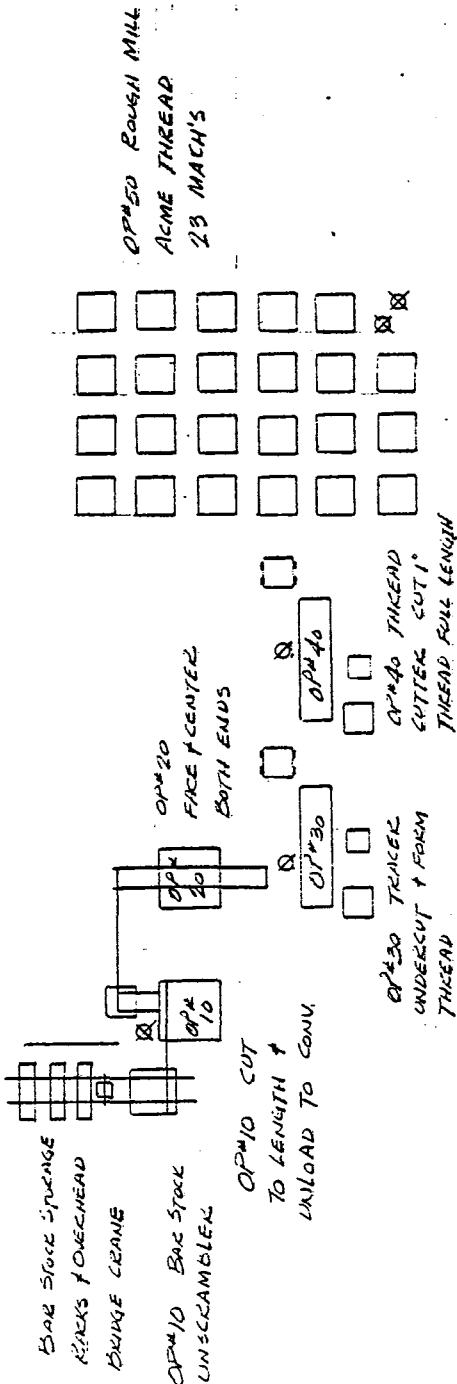
(30)

PLANT PROGRAM OR ECA NO. FORD AEROSPACE		PART NAME S. S. SHAFT				ISSUE DATES		DEPARTMENT. PART NO.							
FOR MODELS ELEVATION DRIVE ASSEMBLY		MATERIAL PLANT ENGINEERING REQUIREMENTS		WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 6 OF 6						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. SEVS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRAVEL		
1.	CHIP - COOLANT AND CLARIFICATION SYSTEMS					500,000	300,000		200,000						
2.	COOLANT REFRIGERATION SYSTEM														
3.	EXHAUST - FUME - DUST AND VENTILATION														
4.	CO2 FIRE PROTECTION SYSTEM														
5.	MONORAIL CONVEYORS	400' @ 200				80,000	40,000		40,000						
6.	MONORAIL CARRIERS (TOOLING)	100' @ 200 on 4' CENTERS								20,000					
7.	ROLLER CONVEYOR														
8.	POWERED CONVEYORS														
9.	PLATFORMS - STILES														
10.	SERVICE RAILS AND HOISTS					15,500	50,000	500	5,000	5,000					
11.	TOOL CABINETS - RACKS AND STANDS	10				11,000	8,000		3,000						
12.	TOOL CONTROL BOARDS														
13.	WORK - GAGING AND INSPECTION TABLES	10				10,000	5,000		5,000						
14.	PARTS BASKETS (EXPENSE)														
15.	PRODUCTION AIDS - ASSEMBLY AIDS														
16.	SECONDARY LIGHTING					4,000	1,000		3,000						
17.	PROGRAMMABLE CONTROLLERS														
18.	AUTOMATION - PART HANDLING SYSTEM														
19.	ENGINEERING SERVICES DESIGN - (EXPENSE)														20,000
20.	BUILDING SERVICES - UTILITIES														
21.	POWER AND FREE CONVEYOR SYSTEM														
22.	POWER AND FREE CONVEYOR CARRIERS (TOOLING)														
23.	MACHINE FOUNDATIONS AND DECKS														
24.	PLANT REARRANGEMENT (EXPENSE)														
25.	MATERIALS HANDLING - RACKS - CONTAINERS - DUNNAGE STORAGE CARTS - (26) FOR 4 DAY FLOAT @ \$800 = 4 FOR ASSY.- FLOAT @ \$800.					25,000	24,000	1,000							
	48 SHAFTS/CART														
	BUILDING CONSTRUCTION	20,000 SQ. FT.													
<b>TOTALS</b>						645,500				25,000					20,000
<b>REMARKS</b>															
FACILITIES - 10,385,000															
TOOLING - 662,000															
PLT. ENGR. 665,000															
	PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.						
	INDUSTRY ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	RECMTS. PC/HR.	HRB.	SUPERSEDES:						

*Ford* Mfg. Development  
Engrg. & Research

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SAFT REQD 20,000

ELEVATOR DRIVE ASSEMBLY  
 S.S. SHAFT - D651140-1B  
 DETAIL - B -

RACK PARTS  
 FOR ASSEMBLY

OP#100  
 FINAL INSPECTION

OP#90  
 MONORAIL  
 WASHER AVAILABLE

OP#10 FINISH MILL  
 ACME THREAD 23 MACH'S

OP#80 MILL FLATS  
 DRILL & REAM

OP#30 TRACER  
 UNDERCUT & FORM  
 THREAD

OP#10 CUT  
 TO LENGTH &  
 UNLOAD TO CONV

OP#20  
 FACE & CENTER  
 BOTH ENDS

OP#50 ROUGH MILL  
 ACME THREAD  
 23 MACH'S

OP#60  
 4 PORTABLE STORAGE  
 CARTS

651140-18 DETAIL 9

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PROCESS ESTIMATE SHEET

PROGRAM OR CER NO. HELIOSTAT		PART NAME S. S. SPACER			ISSUE DATES 9-2-80 PROC. 3-28-80 DES.			DEPARTMENT: STEEL MACHINING						
FOR MODELS ELEVATION DRIVE ASSEMBLY		MATERIAL C1215			WT./ LBS.	RGH. .2822	FIM.	PART NO. A651140-21A		RELEASE 3-28-80	SHEET 1 OF 4			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. BYO/AT	
5	RECEIVE TUBING STOCK	STOCK RACKS												
		HOIST AVAILABLE FROM DETAIL B												
10	LOAD BARS INTO ABRASIVE CUTOFF MACHINE - CUTOFF SPACER BLANKS .40 MIN PER PC	ABRASIVE CUTOFF MACHINE RESINOID ALUM O WET	1	96	0.50	AVAILABLE DETAIL B REQ 6				7,000				
TOTALS										7,000				
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR. J. CALHOUN	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE 50,000 PER YR		REQ'D. PER VEHICLE ONE		NEXT ASSY:		OPER. NO.	
		INDUSTR. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESIAN	PRODN.	DAILY PLT. PLANNING VOLUME 20R		REQNTS. 13 PC/HR. 16 HRS.		SUPERSEDES:			

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PROCESS ESTIMATE SHEET

PLANT \_\_\_\_\_ DEPARTMENT: STEEL MACHINING

PROGRAM OR ECR NO.	PART NAME S. S. SPACER	ISSUE DATES 9-2-80 PROC	PART NO. A651140-21A
FOR MODELS ELEVATION DRIVE ASSEMBLY	MATERIAL C1215	WT./ LBS. RGH. F.W.	RELEASE 3-28-80
		3-28-80 DES	SHEET 2 OF 4

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. (TRYOUT)	
20	LOAD PART ONTO ROTOR/ MAGNETIC CHECK-GRIND ONE FACE. TURNOVER GRIND SECOND FACE  MCT 4.2 MIN/20 PC .21 MIN/PC	BLANCHARD GRINDER	1	182	0.26	AVAILABLE FROM DETAIL 3				2,000	200	1,800		
30	DEMAGNETIZE	DEMAG. COIL	1		INC IN MACH CYCLE	AVAILABLE DETAIL 3								
40	BORE ID TO SIZE CHUCK ON O.D. LOCATE ON SURFACE 'A' MCT=.71 MIN/PC	SINGLE SPINDLE BORE	1	54	0.90	72,000	66,000	1,000	5,000	30,000	5,000	25,000		
<b>TOTALS</b>						72,000				32,000				

REMARKS

PROCESS ENGR. J. CALHOUN	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTRL.	DESIGN PLT. ENGR.	MATH. MDLG. ENGR. PRODN.	DAILY SERVICE 50,000 DAILY PLT. PLANNING VOLUME 208	REQ'D. PER VEHICLE ONE REQMTS. 13 PC/HR. 16 HRS.	NEXT ASSY: SUPERSEDES:	OPER. NO.
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Mfg. Development  
Engrg. & Research

**PROCESS ESTIMATE SHEET**

PLANT		<b>PROCESS ESTIMATE SHEET</b>						DEPARTMENT: <span style="float:right">(31)</span>							
PROGRAM OR ECR NO.		PART NAME			ISSUE DATES		PART NO.								
FOR MODELS		MATERIAL			WT./		RGH.		PM.						
ELEVATION DRIVE ASSEMBLY		C1215			LBS.		9-2-80		3-28-80						
							A651140-21A		SHEET 3 OF 4						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	MAINT. TRY/CT		
50	WASH	INDUSTRIAL PARTS WASHER			INC. IN MACH. CYC	AVAILABLE									
60	FINAL INSPECTION, SHIP TO ASSEMBLY AREA	BENCH RACKS LIGHTING GAGES								3,000	400	2,600			
	PERSONAL RELIEF				0.11										
<b>TOTALS</b>					1.77					3,000					
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR. J. CALHOUN	PLT. LAYOUT	AUTOMATION	DESIGN	NATL. MDLG. ENGR.	DAILY SERVICE 50,000 PER YR	REQ'D. PER VEHICLE ONE	NEXT ASSY:	OPER. NO.					
		INDUSTR. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME 208	REQMTS. 13 PC/HR. 16 HRS.	SUPERSEDES:						

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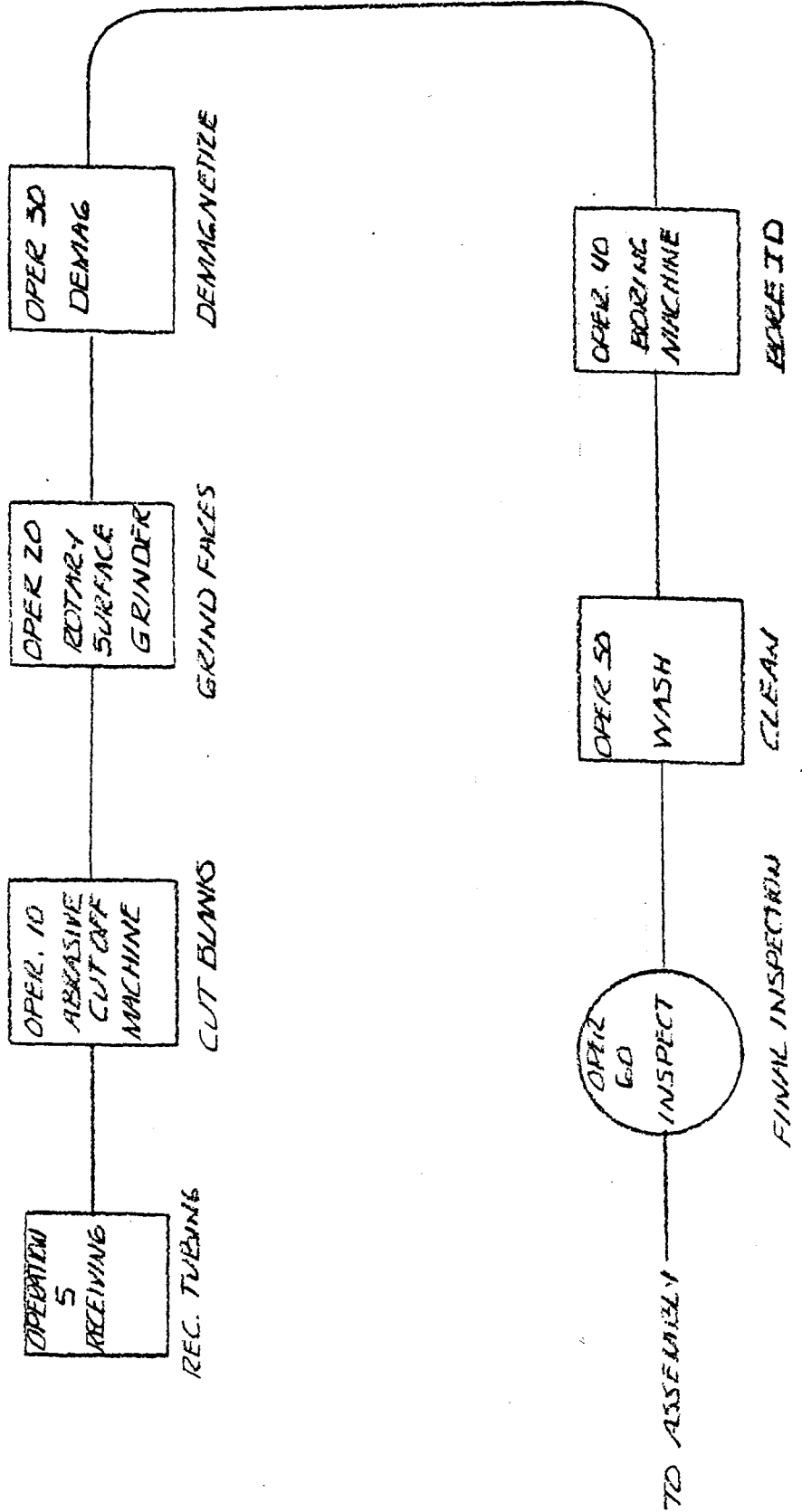
PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO. HELIOSTAT		PART NAME S.S. SPACER			ISSUE DATES				DEPARTMENT A651140-21A					
FOR MODELS ELEVATION DRIVE ASSEMBLY		MATERIAL PLANT ENGINEERING REQUIREMENTS			WT./ LBS.	RGH.	PM.	RELEASE		SHEET 4 OF 4				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRNG/CT	
1	CHIP - COOLANT AND CLARIFICATION SYSTEMS					10,000	7,000	500	2,500					
2	COOLANT REGRIGERATION SYSTEM													
3	EXHAUST - FUME - DUST AND VENTILATION													
4	CO2 FIRE PROTECTION SYSTEM													
5	MONORAIL CONVEYORS	AVAILABLE												
6	MONORAIL CARRIERS (TOOLING)	AVAILABLE												
7	ROLLER CONVEYOR													
8	POWERED CONVEYORS													
9	PLATFORMS - STILES													
10	SERVICE RAILS AND HOISTS													
11	TOOL CABINETS - RACKS AND STANDS													
12	TOOL CONTROL BOARDS													
13	WORK - GAGING AND INSPECTION TABLES					1,000	500		500					500
14	PARTS BASKETS (EXPENSE)													
15	PRODUCTION AIDS - ASSEMBLY AIDS													
16	SECONDARY LIGHTING													
17	PROGRAMMABLE CONTROLLERS													
18	AUTOMATION - PART HANDLING SYSTEM													
19	ENGINEERING SERVICES DESIGN - (EXPENSE)													500
20	BUILDING SERVICES - UTILITIES													
21	POWER AND FREE CONVEYOR SYSTEM													
22	POWER AND FREE CONVEYOR CARRIERS (TOOLING)													
23	MACHINE FOUNDATIONS AND DECKS													
24	PLANT REARRANGEMENT (EXPENSE)													
25	MATERIALS HANDLING - RACKS - CONTAINERS - DUNNAGE					5,500	5,000		500					
BUILDING CONSTRUCTION						500 SQ. FT.								
TOTALS						16,500								1,000
REMARKS														
TOTALS: FAC. 88,500 ) TOOLG -- 42,000 ) \$131,500 EXP. 1,000 )														
		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	RECHTS. PC/HR. HRS.	SUPERSEDES:					

Mfg. Development  
Engrg. & Research

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PROCESS LAYOUT FOR  
 SLOW SHAFT SPACER  
 A651ND-21A  
 WINSMITH DRAWING NO. 631140-0029



PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO.		PART NAME			ISSUE DATES		DEPARTMENT: STEEL MACHINING								
FOR MODELS		MATERIAL			WT./	RGH.	FM.	PART NO.		SHEET					
ELEVATION DRIVE ASSEMBLY		4140 ALLOY			LBS.	1356		9-2-80	A651140-44A	4-7-80	1 OF 2				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'Y REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRAVEL		
5	RECEIVE BAR STOCK 4140 ALLOY STEEL														
10	CHUCK ON OD. TURN. FACE DRILL, BORE, REAM & CUTOFF 3 PCS PER CYCLE MCT 3.27 MIN / 3PC OR 1.09 MIN 1 PC	3 INCH TURRET LATHIE	1	35	1.36	71,000	65,000	1,000	5,000	15,000	2,000	13,000			
		MONORAIL DELIVERY TO WASHER													
20	WASH	INDUSTRIAL PARTS WASHER													
25	INSPECTION	GAGES BENCHES								3,000	500	2,500			
	PERSONAL RELIEF				0.09										
TOTALS					1.45										
REMARKS						71,000	18,000								
Mfg. Development Engrg. & Research		PROCESS ENGR. J. CALHOUN	PLY. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLY. ENGR. OHANESIAN	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE 50,000 PER YR	DAILY PLY. PLANNING VOLUME 208	REQ'D. PER VEHICLE ONE	REQNTS. 13 PC/HR. 16 HRS.	NEXT ASSY: ASSEMBLY SUPERSEDES:	OPER. NO. 10-	25		

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PLANT 651140-18 DETAIL 10 PROCESS ESTIMATE SHEET DEPARTMENT

PROGRAM OR ITEM NO. PART NAME S.S. SHAFT WASHER ISSUE DATES PART NO. A651140-44A (32)

FOR MODELS ELEVATION DRIVE ASSEMBLY MATERIAL PLANT ENGINEERING REQUIREMENTS WT./ LBS. RGM. FIN. RELEASE SKETCH 2 OF 2

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQ.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. COST
1	CHIP - COOLANT AND CLARIFICATION SYSTEMS					10,000	7,000	500	2,500				
2	COOLANT REFRIGERATION SYSTEM												
3	EXHAUST - FUME - DUST AND VENTILATION												
4	CCP FIRE PROTECTION SYSTEM												
5	MONORAIL CONVEYORS	100'				20,000	10,000		10,000				
6	MONORAIL CARRIERS (TOOLING)	25 (BASKET CARRIER)								3,000			
7	ROLLER CONVEYOR												
8	POWERED CONVEYORS												
9	PLATFORMS - STILES												
10	SERVICE RAILS AND HOISTS												
11	TOOL CABINETS - RACKS AND STANDS					1,000	500		500				
12	TOOL CONTROL CARDS												
13	WORK - GAGING AND INSPECTION TABLES					1,000	500		500				
14	PART BASKETS (EXPENSE)	75/BSKT. 15 BSKTS=050											1,000
15	PRODUCTION AIDS - ASSEMBLY AIDS												
16	SECONDARY LIGHTING												
17	PROGRAMMABLE CONTROLLERS												
18	AUTOMATION - PART HANDLING SYSTEM												
19	ENGINEERING SERVICES DESIGN - (EXPENSE)												500
20	BUILDING SERVICES - UTILITIES												
21	POWER AND FREE CONVEYOR SYSTEM												
22	POWER AND FREE CONVEYOR CARRIERS (TOOLING)												
23	MACHINE FOUNDATIONS AND DECKS												
24	PLANT REARRANGEMENT (EXPENSE)												
25	MATERIALS HANDLING - RACKS - CONTAINERS - DORAGE												
	BUILDING CONSTRUCTION	500 SQ. FT.											
TOTALS						32,000				3,000			1,500

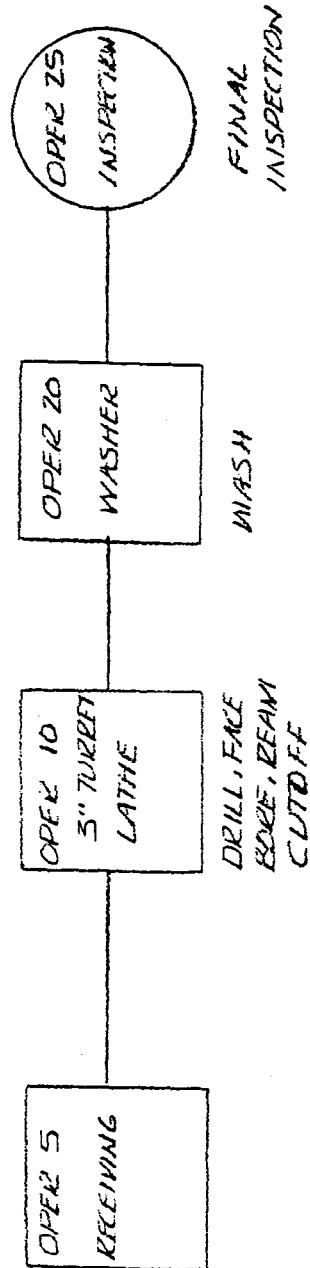
REMARKS TOTALS: FAC. - 103,000 )  
 TOOLG - 21,000 ) 125,000  
 EXP. - 1,500 )

DESIGN	PLANT LAYOUT	AUTOMATION	DESIGN	MAT. HLDG. ENGR.	DAILY SERVICE	NEED. PER VEHICLE	NEAT ASST.	CR. CHG.
TOTAL COSTS	PL. LAYOUT	TOTAL COSTS	PL. LAYOUT	PRODM.	DAILY PLT. PLANNING	RESULTS	SUPPLIERS	

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LAYOUT FOR  
S.S. SHAFT WASHER  
A. 651140-44A  
651140-18 DETAIL 10



D651140-18 DETAIL 27

PROCESS ESTIMATE SHEET

DEPARTMENT: STAINLESS STEEL MACH.

PROGRAM OR ECR NO.		PART NAME			ISSUE DATES		PART NO.								
HELIOSTAT		UPPER STOP COLLAR			9/2/80		A651140-43-B								
FOR MODEL		MATERIAL			WT./	QTY.	FIN.	RELEASE		SHEET					
ELEVATION DRIVE ASSEMBLY		304 STINLESS			LBS.	.894		5/21/80		1 OF 2					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR D.T. NUMBER	MACHS. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRVCT		
5	RECEIVE STAINLESS STEEL IN 2" DIA BARS	HOIST AVAILABLE LOCATE WITH S.S. SHAFT													
10	LOAD BARS IN FEED TUBES CHUCK ON OD CENTER DRILL, CUTOFF TO LENGTH 1.42 MIN. 1 PC.	3 INCH TURRET LATHE	1	27	1.76	73,000	67,000	1,000	5,000	7,000	1,000	6,000			
15	INSPECT, SHIP TO ASSEMBLY	BENCH & CAGES	1							3,000					
	PERSONAL RELIEF				0.12										
TOTALS					1.88	73,000				10,000					
REMARKS															
Mfg. Development Eng. & Research		PROCESS ENGR. J. CALHOUN	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE 50,000 PER YR	REQ'D. PER VEHICLE ONE	NEXT ASSY:	OPER. NO.					
		INDUSTR. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESIAN	PRODN.	DAILY PLT. PLANNING VOLUME 208	RECHTS. 13 PC/HR. 16 HRS.	SUPERSEDES:						

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PROCESS ESTIMATE SHEET

PLANT

DEPARTMENT

PROGRAM OR ECR NO.		PART NAME			ISSUE DATES			PART NO.						
HELIOSTAT		UPPER STOP COLLAR						A-651140-43B						
FOR MODELS		MATERIAL			WT./			RELEASE		SHEET		OF		
ELEVATION DRIVE ASSEMBLY		PLANT ENGINEERING REQUIREMENTS			LBS.					2		2		
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYS/22	
1.	CHIP - COOLANT AND CLARIFICATION SYSTEMS					10,000	7,000	500	2,500					
2.	COOLANT REFRIGERATION SYSTEM													
3.	EXHAUST - FUME - DUST AND VENTILATION													
4.	CO2 FIRE PROTECTION SYSTEM													
5.	MONORAIL CONVEYORS	100'				20,000	10,000		10,000					
6.	MONORAIL CARRIERS (TOOLING)									2,500				
7.	ROLLER CONVEYOR													
8.	POWERED CONVEYORS													
9.	PLATFORMS - STILES													
10.	SERVICE RAILS AND HOISTS													
11.	TOOL CABINETS - RACKS AND STANDS					1,000	500		500					
12.	TOOL CONTROL BOARDS													
13.	WORK - GAGING AND INSPECTION TABLES					1,000	500		500					
14.	PARTS BASKETS (EXPENSE)													500
15.	PRODUCTION AIDS-ASSEMBLY AIDS													
16.	SECONDARY LIGHTING													
17.	PROGRAMMABLE CONTROLLERS													
18.	AUTOMATION-PART HANDLING SYSTEM													
19.	ENGINEERING SERVICES DESIGN-(EXPENSE)													1,000
20.	BUILDING SERVICES-UTILITIES													
21.	POWER AND FREE CONVEYOR SYSTEM													
22.	POWER AND FREE CONVEYOR CARRIERS (TOOLING)													
23.	MACHINE FOUNDATIONS AND DECKS													
24.	PLANT REARRANGEMENT (EXPENSE)													
25.	MATERIALSHANDLING - RACKS-CONTAINERS-DUNNAGE BAR STG.					5,500	5,000		500					
	BUILDING CONSTRUCTION	400 SQ. FT												
TOTALS						37,500			2,500					1,500

REMARKS  
 TOTALS: F-110.5  
           T- 12.5  
           E- 6.5

124.5

PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.
INDUSTY. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQ'TS. PC/HR.	SUPERSEDES: HRS.	

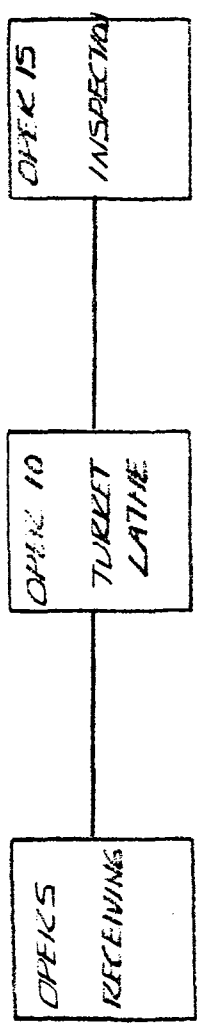
Mfg. Development  
 Engrg. & Research

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PROCESS SEQUENCE FOR  
UPPER STOP COLLAR  
A65140-93A  
D65140-15 DETAIL Z7

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PROCESS ESTIMATE SHEET

PLANT \_\_\_\_\_

DEPARTMENT \_\_\_\_\_

PROGRAM OR ECR NO. HELIOSTAT		PART NAME LOWER STOP COLLAR				ISSUE DATES 9-19-80		PART NO. A-651140-48A							
FOR MODELS ELEVATION DRIVE ASSEMBLY		MATERIAL 304 STAINLESS COLD DRAWN			WT./ LBS.	RGH. 2.93	FIN.	RELEASE	SHEET 1 of 5						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL- LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
50	RECEIVE 304 STAINLESS STEEL BAR STOCK 2.750" O.D.	RACKS HOIST CABLE													
10	CUT OFF BAR STOCK TO LENGTH MCT = 1.25 MIN PER PC.	METAL CIRCULAR CUTOFF SAW COOLANT V-BLOCK FIXTURE WITH DRILL BUSHING	1	30	1.60	17,250	15,000	250	2,000	2,000					
<b>TOTALS</b>						17,250	15,000	250	2,000	2,000					
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR. J. CALHOUN	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE 100,000 PER YR.	REQ'D. PER VEHICLE TWO	NEXT ASSY:		OPER. NO.				
		INDUSTRL ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME 416	REQMTS. 26 PC/HR. 16 HRS.	SUPERSEDES:						

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**PROCESS ESTIMATE SHEET**

PLANT _____		<b>PROCESS ESTIMATE SHEET</b>								DEPARTMENT _____					
PROGRAM OR EEA NO. HELIOSTAT		PART NAME LOWER STOP COLLAR				ISSUE DATES 9-19-80		PART NO. A 651140-48A							
FOR MODELS ELEVATION DRIVE ASSEMBLY		MATERIAL 304 STAINLESS		WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 2 OF 5						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRVCT		
20	LOCATE ON OD & CLAMP PILOT DRILL CENTER HOLE MCT = 1.23 MIN/PC	SINGLE SPINDLE VERTICAL DRILL PRESS - MORSE TAPER MULTI-FEED & SPEED  COOLANT PUMP	1	31	1.55	21,900	19,000	300	2,600	2,000					
30	LOCATE & CLAMP O.D. DRILL ID TO 1.250 DIA.  MCT = 1.26 MIN/PC	SINGLE SPINDLE DRILL PRESS  COOLANT PUMP	1	30	1.60	USE DRILL PRESS FROM OPERATION 20				2,000					
35	DAMPEN BOTH ENDS .50 MIN/PC	DRILL PRESS		77	.62	USE DRILL PRESS FROM OPERATION 20 OP 20				1,000					
<b>TOTALS</b>						21,900	19,000	300	2,600	5,000					
REMARKS * TWO PARTS FORMED WHEN SLIT IN HALF AT OPERATION 30.															
Mfg. Development Engrg. & Research		PROCESS ENGR. J. CALOUN	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE 100,000 PER YR.	REQ'D. PER VEHICLE TWO*	WERT ASSY. SUPERSEDES:	OPER. NO.					
		INDUSTY. ENGR.					DAILY PLY. PLANNING VOLUME 416	REQMTS. 26 PC/HR. 16 HRS.							

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PROCESS ESTIMATE SHEET

PLANT _____		DEPARTMENT _____													
PROGRAM OR CER NO. HELIOSTAT		PART NAME LOWER STOP COLLAR				ISSUE DATES 9-19-80				PART NO. A651140-48A					
FOR MODELS ELEVATION DRIVE ASSEMBLY		MATERIAL 304 STAINLESS STEEL				WT./ LBS.    RGH.    FIN.				RELEASE		SHEET 3 OF 5			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. (BYCOST)		
40	CUT TUBE INTO 2 PIECES  1.07 MIN/PC	METAL CIRCULAR SAW	1	35	1.37	USE CUTOFF MACHINE FROM OPER 10					2,000				
50	MOUNT IN FIXTURE - FLAT UP - DRILL BOLT HOLE AND TAP HOLE. MOVE FIXTURE AND REPEAT  NCT = 1.22 MIN/PC	TWO SPINDLE DRILL PRESS  FIXTURE  COOLANT AND PUMP	1	31	1.55	27,600	24,000	360	3,240	2,000					
TOTALS						27,600	24,000	360	3,240	4,000					
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR. J. CALHOUN	PLY. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE 100,000 PER YR.	REQ'D. PER VEHICLE TWO	NEXT ASSY:	OPER. NO.					
		INDUSTRY ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLY. PLANNING VOLUME 415	REQMTS. 26 PC/HR. 16 HRS.	SUPERSEDES:						

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PROCESS ESTIMATE SHEET

PROGRAM OR CCR NO. HELIOSTAT		PART NAME LOWER STOP COLLAR				ISSUE DATES 9-19-80		DEPARTMENT						
FOR MODELS ELEVATION DRIVE ASSEMBLY		MATERIAL 304 STAINLESS				WT./ LBS.		RGH.		FIN.				
PART NO. A651140-48A		RELEASE		SHEET 4		OF 5								
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LAYON	TOTAL	DESIGN	BUILD		INST. TROY/QT
60	LOAD PART IN FIXTURE TAP TWO THREADED HOLES MCT .426 MIN/PC	PRODUCTION DRILL PRESS WITH TAPPING HEAD	1	83	.58	25,300	19,000 3,000	300	3,000	2,000				
70	COUNTER BORE TWO HOLES MCT = 1.20 MIN/PC	PRODUCTION DRILL PRESS	1	32	1.50	USE OPERATION 50 MACHINING				2,000				
75	FINAL INSPECTION  PERSONAL RELIEF	GAGES			IND. LAB  .69					3,000				
TOTALS					11.06	23,300	22,000	300	3,000	7,000				
REMARKS														
Mfg. Development Engg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQ'TS. PC/HR.	SUPERSEDES:					

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PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO.		PART NAME			ISSUE DATES		DEPARTMENT							
HELIOSTAT		LOWER STOP COLLAR					PART NO. A-65110-48B							
FOR MODELS		MATERIAL			WT./	RGH.	FM.	RELEASE		SHEET	OF			
ELEVATION DRIVE ASSEMBLY		PLANT ENGINEERING REQUIREMENTS			LBS.					5	5			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. SERVIC.	
1.	CHIP - COOLANT AND CLARIFICATION SYSTEMS					15,500	10,000	500	5,000					
2.	COOLANT REFRIGERATION SYSTEM													
3.	EXHAUST - FUME - DUST AND VENTILATION													
4.	CO2 FIRE PROTECTION SYSTEM													
5.	MONORAIL CONVEYORS	200'				40,000	20,000		20,000					
6.	MONORAIL CARRIERS (TOOLING)	100 @ 4'C								10,000				
7.	ROLLER CONVEYOR					10,000	7,000		3,000					
8.	POWERED CONVEYORS													
9.	PLATFORMS - STILES													
10.	SERVICE RAILS AND HOISTS					10,000	7,000		3,000	2,000				
11.	TOOL CABINETS - RACKS AND STANDS					3,000	2,000		1,000					
12.	TOOL CONTROL BOARDS													
13.	WORK - GAGING AND INSPECTION TABLES					4,000	2,000		2,000					
14.	PARTS BASKET (EXPENSE)	65												3,500
15.	PRODUCTION AIDS - ASSEMBLY AIDS													
16.	SECONDARY LIGHTING													
17.	PROGRAMMABLE CONTROLLERS													
18.	AUTOMATION - PART HANDLING SYSTEM													
19.	ENGINEERING SERVICES DESIGN (EXPENSE)													2,000
20.	BUILDING SERVICES - UTILITIES													
21.	POWER AND FREE CONVEYOR SYSTEM													
22.	POWER AND FREE CONVEYOR CARRIERS (TOOLING)													
23.	MACHINE FOUNDATIONS AND DECKS													
24.	PLANT REARRANGEMENT (EXPENSE)													
25.	MATERIALS HANDLING - RACKS - CONTAINERS - DUNNAGE - BAR STOCK					5,000	4,000		1,000					
BUILDING CONSTRUCTION		2000 SQ. FT.												
TOTALS						87,500				12,000				5,500
REMARKS TOTALS: F. - 90,050 T. - 18,000 + 12 + 5.5 } 213.1 E. - 87,500														
PROCESS ENGR.		PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO.				
INDUSTY. ENGR.		LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS.	SUPERSEDES:						
Mfg. Development							PC/NR.	NRS.						
Engrg. & Research														

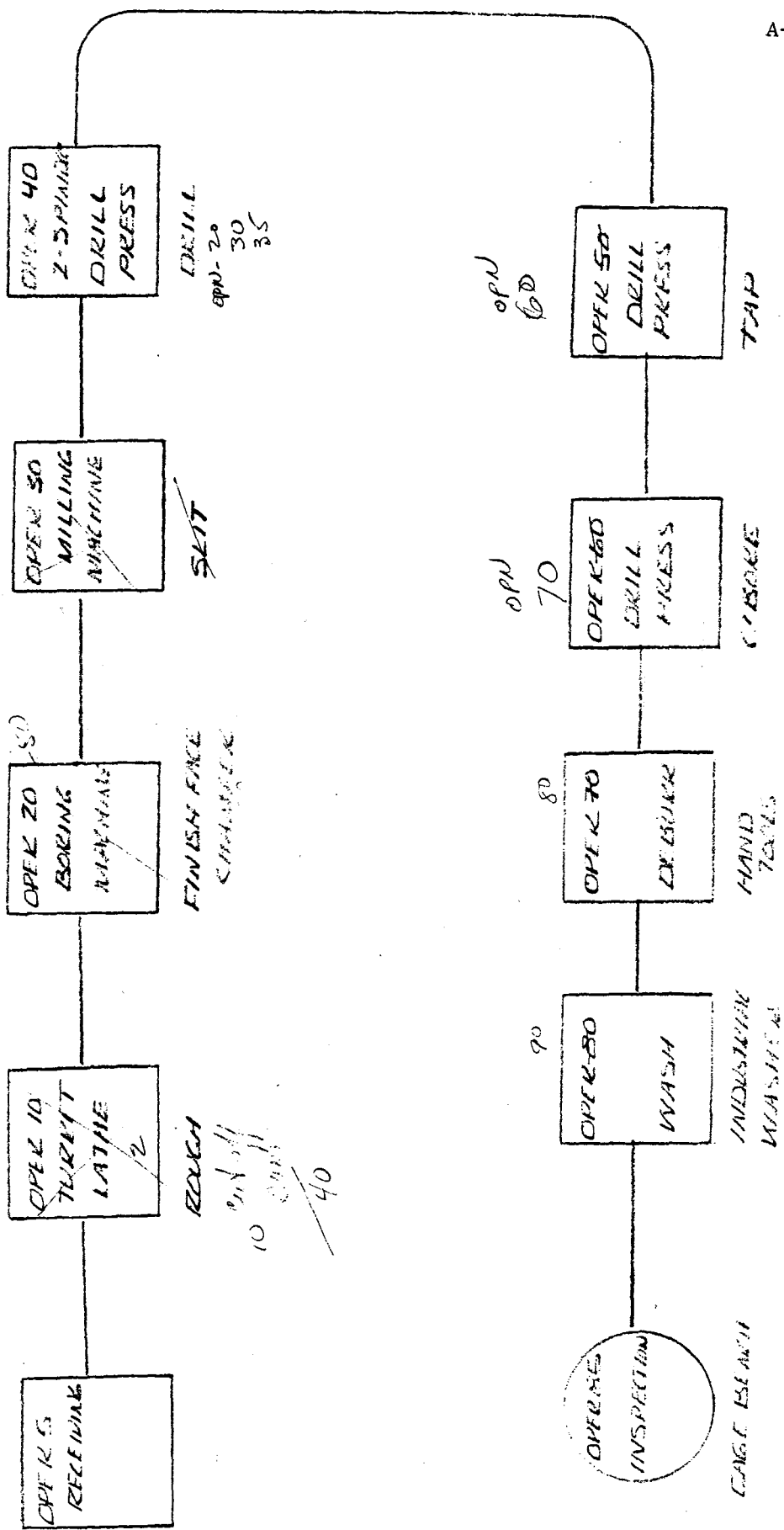
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PROCESS SHEET FOR  
LOWER STOP COLLAR  
A651140-41A5  
D651140-15 DETAIL 28

Revised  
9-25-59



PROCESS ESTIMATE SHEETS  
REFLECTOR PANEL SUPPORT FRAME

H-Frame Assembly A-231

Reinforcement Angle	Part # 277-10120-4	1 sheet
Reinforcement Angle	277-10120-12	1 sheet
Reinforcement Bar	277-10120-8	2 sheets
Strut	277-10120-5	1 sheet

Attachment Bracket Assembly A-236

Subassembly; Attachment Bracket Ass'y Ref'l	277-10119	2 Sheets
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Attachment Bracket A-238

Plate, Attachment Bracket - Reflector	Part# 277-10119-13	1 sheet w/detail 2B3
Plate, Attachment Bracket - Reflector	277-10119-14	1 sheet w/detail 2B3
Plate, Attachment Bracket - Reflector	277-10119-17	1 sheet w/detail C3
Attachment Bracket - Reflector	277-10119-18	1 sheet w/detail B4
Doubler - Reinforcement Plate - Reflector	277-10119-19	1 sheet w/detail

PROCESS ESTIMATE SHEET

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PROGRAM OR EEM NO.		PART NAME				ISSUE DATES			DEPARTMENT					
HELIOSTAT		REINFORCEMENT ANGLE				9-5-80			277-10120-4					
FOR MODELS		MATERIAL CARBON STEEL SHAPE PER ASTM - A36-70 <sup>a</sup>				WT./ LBS.	RGH.	FIN.	RELEASE	SHEET OF				
						1.126								
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL- LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
	MATERIAL: L SHAPED ANGLE STEEL 1" x 1" x 1/8 IN 16" LENGTH PURCHASE IN 16' STRIPS CUT 12 L SUPPORTS PER STRIP													
10	SAW THREE (3) PIECES PER PASS	DO-ALL TYPE AUTOMATIC FEED BAND SAW	1	720	.07				SAME AS USED FOR PART 277-1020-5					
20	FIRST STAGE PIERCE THREE (3) HOLES CLEARANCE 1/4" BOLT SECOND STAGE ROTATE 90° AND PIERCE TWO (2) HOLES CLEARANCE FOR 1/4" BOLT	OBI 80 TON PRESS	1	400	0.12				SAME AS USED FOR PART 277-10121-2	5,400	450	4,500	450	
30	DELIVER TO GALVINIZING AREA AND GALVINIZE TO SPEC. ASTM A385- 76-2.00 OZ. FT <sup>2</sup>				IND LAB									
40	DELIVER TO "H" FRAME ASS'Y AREA PERSONAL RELIEF				IND. LAB									
TOTALS					0.20					5,400				
REMARKS: TOTALS: FAC. - 0 ) TOOLG - 5,400 ) 5,400 EXP - 0 )														
	PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
	HARDWAY						8							
	INDUSTRIAL ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESIAN	PRODN.	DAILY PLT. PLANNING VOLUME	REQD. MTS.	SUPERSEDES:						
	Mfg. Development Engrg. & Research					1664	104 PC/MR. 16 HRS.							

PROCESS ESTIMATE SHEET

PROGRAM OR EEM NO.		PART NAME				ISSUE DATES				PART NO.				
HELIOSTAT		REINFORCEMENT ANGLE				9-5-80				277-10120-12				
FOR MODELS		MATERIAL		WT./	RGH.	FIN.			RELEASE	SHEET		OF		
		CARBON STEEL SHAPE PER ASTM-A36-70 <sup>B</sup>		LBS.	1.28	1.28				1		1		
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. SECS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
	MATERIAL: L SHAPED ANGLE STEEL 1" x 1" x 1/8 IN 18.2" LENGTH PURCHASED IN 14' STRIPS CUT 9 L SUPPORTS PER STRIP													
10	SAW THREE (3) PIECES PER PASS 18.2" LENGTH	DO-ALL TYPE AUTOMATIC FEED BAND SAW	1	720	07					SAME AS USED FOR PART 277-10120-5				
20	PIERCE FOUR (4) HOLES CLEARANCE FOR 5/16" BOLT	DB1 80 TON PRESS	1	500	10	46,050	35,000	1,050	1,000	4,320	360	3,600	360	
30	DELIVER TO GALVANIZING AREA AND GALVANIZE TO SPEC. ASTM A385- 76-2.00 OZ. FT <sup>2</sup>				ND. LAB.									
40	DELIVER TO "H" FRAME ASS'Y AREA				ND. LAB.									
	PERSONAL RELIEF				01									
<b>TOTALS</b>					18	46,050				4,320				
REMARKS TOTAL: FAC - 46,050 ) 50,370 TOOL - 4,320 )														
Mfg. Development Engrg. & Research		PROCESS ENGR. HARDWAY INDUST. ENGR. S. LEWIS	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR. OHANESTAN	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME 3,328	REQ'D. PER VEHICLE 16 REQMTS. 208 PC/HR. 16 HRS.	NEXT ASBY: "H" FRAME SUPERSEDES:	OPER. NO.				

**PROCESS ESTIMATE SHEET**

PLANT FORD AEROSPACE

DEPARTMENT: \_\_\_\_\_

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PROGRAM OR ECR NO. HELIOSTAT		PART NAME REINFORCEMENT BAR				ISSUE DATES 9-5-80		PART NO. 277-10120-8						
FOR MODELS 50,000 ANN. VOL.		MATERIAL CARBON STEEL BAR ASTM- A36-70 <sup>a</sup>		WT./ LBS.	RGH. 2.386	FIN. 2.240	RELEASE		SHEET 1 OF 2					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'Y REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				
						TOTAL	BASIC	FREIGHT	INSTAL- LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	EXPENSE COST
	MATERIAL: CARBON STEEL BAR 3/4" x 1" x 11.3" LENGTH PURCHASED IN 57" BAR CUT 5 11.3 PIECES													
10	SAW THREE (3) PIECES PER PASS	DO-ALL TYPE AUTOMATIC FEED BAND SAW	1	600	.08					SAME AS USED FOR PART 277-10120-5				
20	MILL TWO SLOTS 1.820" SPHER. RAD. .280" DEEP	ARBOR MILL #3	1	60	.80	40,050	35,000	1,050	4,000					
30	DRILL THREE CLEARANCE HOLES 1/4 BOLT	THREE CHUCK MULTIPLE HEAD DRILL PRESS	1	60	.80	45,200	40,000	1,200	4,000	2,400	200	2,000	200	
40	ROTATE 90° AND DRILL FOUR (4) CLEARANCE HOLES FOR 1/4" BOLT	FOUR CHECK MULTIPLE HEAD DRILL PRESS	1	60	.80	58,560	52,000	1,560	5,000	3,000	250	2,500	250	
50	DRILL TWO (2) HOLES 1/8" DIM.	TWO CHUCK MULTIPLE HEAD DRILL PRESS	1	60	.80	28,750	25,000	750	3,000	1,440	120	1,200	120	
<b>TOTALS</b>						172,560				6,840				
<b>REMARKS</b>														
Mfg. Development Engg. & Research		PROCESS ENGR. HARDWAY	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTRIAL ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESIAN	PRODM.	DAILY PLT. PLANNING VOLUME 832	REQMTS. 52 PC/HR. 16 HRS.	H FRAME SUPERSEDES.					

PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO. HELIOSTAT FOR MODELS 50,000 ANN. VOL.		PART NAME REINFORCEMENT BAR				ISSUE DATES 9-5-80			PART NO. 277-10120-8						
MATERIAL		WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 2 OF 2								
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRAVEL		
60	DELIVER TO GALVINIZING AREA AND GALVINIZE TO SPEC. ASTM-A385- 76-2.00 OZ. FT <sup>2</sup>				END. LAB.										
70	DELIVER TO H FRAME ASS'Y AREA				END. LAB.										
	PERSONAL RELIEF				22										
TOTALS					3.50										
REMARKS TOTAL: FAC - 172,560 } TOOL - 6,840 } 179,400															
Mfg. Development Engrg. & Research		PROJ. ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO.				
		HARDWAY	INDUSTRL. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	RECHTS.	PC/HR.					MRS.

PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT: \_\_\_\_\_

52

PROGRAM OR ECR NO. HELIOSTAT		PART NAME STRUT			ISSUE DATES 9-4-80			PART NO. 277-10120-5							
FOR MODELS		MATERIAL CARBON STEEL SHAPE PER ASTM-A36-70 <sup>a</sup>			WT./ LBS.	QTY. 4.5	FIN. 4.5	RELEASE		SHEET OF 1					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRY/QT		
	MATERIAL: L SHAPED ANGLE STEEL 1" x 1" x 1/8 IN 63.9" LENGTH PURCHASED IN 16' LENGTH CUT TO 3 STRUTS PER STRIP														
10	SAW THREE (3) PIECES PER PASS 63.9" LENGTH	DO-ALL TYPE AUTOMATIC FEED TYPE BAND SAW	1	720	.07	50,350	45,000	1,350	4000						
20	PIERCE THREE (3) HOLES - CLEARANCE FOR 1/4 BOLT	HYDRO PIERCING FIXTURE W/3 PIERCING C FRAMES	1	600	.08	5,675	4,500	135	1000	2,400	200	2,000	200		
30	DELIVER TO GALVANIZING AREA AND GALVANIZE TO SPEC. ASTM A385-76 2.00 OZ FT														
40	DELIVER TO H FRAME ASS'Y AREA														
	PERSONAL RELIEF														
<b>TOTALS</b>					0.16	56,025				2,400					
REMARKS TOTAL: FAC - 56,025) 58,425 TOOL- 2,400)															
PROCESS ENGR. HARDWAY		PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO.					
INDUSTY. ENGR. S. LEWIS		LAB.	QUAL. CONTR.	PLT. ENGR. DHANESIAN	PRODN.	DAILY PLT. PLANNING VOLUME	8	"H" FRAME							
Mfg. Development Engr. & Research						1,664	104 PC/HR.	16 HRS.		SUPERSEDES:					



65.1

PLANT <u>FORD AEROSPACE</u>		960/HR GROSS		<b>PROCESS ESTIMATE SHEET</b>				DEPARTMENT: _____						
PROGRAM OR ECR NO. <u>HELIOSTAT</u>			PART NAME <u>ATTACHMENT BRACKET ASS'Y REFLECTOR</u>				ISSUE DATES <u>5/1/80</u>		PART NO. <u>277-10119</u>					
FOR MODELS <u>50,000 ANN. VOL.</u>			MATERIAL <u>SUB-ASSEMBLY</u>			WT./ LBS.		RGH.		FIN.		RELEASE	SHEET <u>1</u> OF <u>2</u>	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TAYOAT	
	SUB-ASSEMBLY CONSISTS OF THE FOLLOWING													
	DETAIL AND VOLUMES													
	BRACKET	PLATE	QUANTITY											
		<u>277-10119-18/ - 17</u>	<u>16</u>											
		<u>277-10119-18/ - 14</u>	<u>24</u>											
		<u>277-10119-18/ - 13</u>	<u>8</u>											
	<b>TOTAL SUB-ASSEMBLIES</b>		<b>48</b>											
<b>10</b>	<b>POSITION (1) BRACKET</b>	<b>PROJECTION</b>	<b>2</b>	<b>720</b>	<b>.07</b>	<b>119,000</b>	<b>100,000</b>	<b>4,000</b>	<b>15,000</b>	<b>80,000</b>				
<b>B</b>	<b>(277-10119) AND (1) PLATE</b>	<b>WELDER</b>												
	<b>(DETAIL 17) INTO FIXTURE</b>	<b>(2) STATION (2)</b>												
	<b>AND WELD IN (2) LOCATIONS</b>	<b>POSITION</b>												
		<b>MANUAL LOAD</b>												
		<b>AUTO INDEX &amp;</b>												
		<b>UNLOAD</b>												
<b>TOTALS</b>						<b>119,000</b>				<b>80,000</b>				
<b>REMARKS</b>														
Mfg. Development Engrg. & Research		PROCESS ENGR. <b>OHANESIAN</b>	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTY. ENGR. <b>S. LEWIS</b>	LAB.	QUAL. CONTR.	PLT. ENGR. <b>OHANESIAN</b>	PRODN.	DAILY PLT. PLANNING VOL. 9984	REQMTS. 624 PC/HR. 16 HRS.	48	SUPERSEDES.				

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1510

PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR CER NO. HELIOSTAT		PART NAME ATTACHMENT BRACKET - REFLECTOR				ISSUE DATES 5/1/80		PART NO. 277-10119						
FOR MODELS 50,000 ANN. VOL.		MATERIAL SUB-ASSEMBLY		WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 2	OF 2				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
10 B	CONTINUED CHANGE OVER FOR	ADJUST FIXTURE												
	DETAIL - 14	LOCATORS												
10 C	CHANGE OVER FOR	ADJUST FIXTURES												
	DETAIL-13	LOCATORS												
20	INSPECT WELDS	MANUAL			IND. LAB					2,000				
30	DELIVER TO GALVANIZE OPERATION				IND. LAB									
40	GALVANIZE PER SPEC				GAL. SYST									
50	DELIVER TO ASSEMBLY				IND. LAB									
-	PERSONAL RELIEF				.01									
TOTALS					.08					2,000				
REMARKS TOTAL: FAC-119,000 } -201,000 TOOL-82,000 }														
PROCESS ENGR.		PLT. LAYOUT		AUTOMATION		DESIGN		MATL. MDLG. ENGR.		DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:
INDUSTR. ENGR.		LAB.		QUAL. CONTR.		PLT. ENGR.		PRODN.		DAILY PLT. PLANNING VOLUME		REQ'TS. PC/HR. HRS.		SUPERSEDES:

*Ford* Mfg. Development Engrg. & Research

PROCESS ESTIMATE SHEET

PLANT

DEPARTMENT

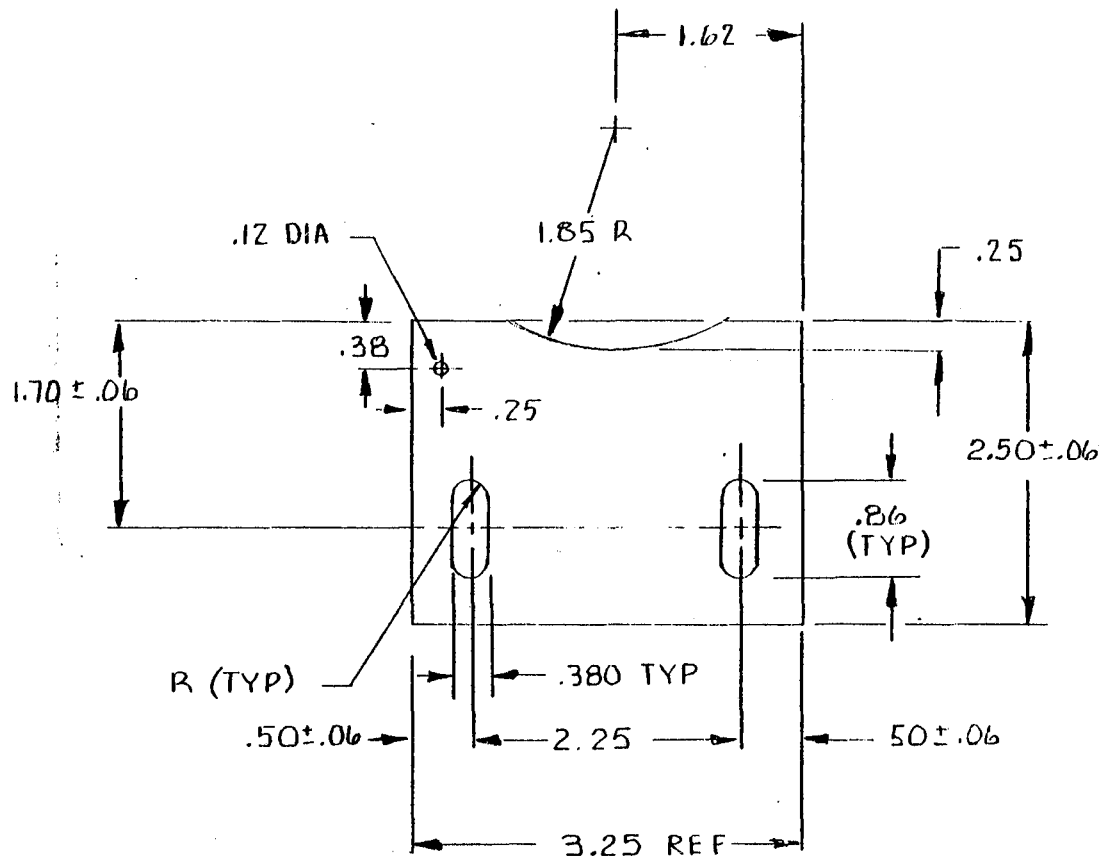
67

PROGRAM OR ECR NO. HELLOSTAT		PART NAME PLATE ATTACHMENT BRACKET - REFLECTOR				ISSUE DATES 9-2-80		PART NO. 2772-10119-13							
FOR MODELS		MATERIAL ASTM A-715-75- GRADE 80		WT./ LBS.	QTY. 443	FIN. 407	RELEASE		SHEET 1 OF 1						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR D.Y. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTAL- LATION	TOTAL	DESIGN	BUILD	INST. TOOL		
	MATERIAL: HOT ROLLED STEEL IN SHEETS OF 32.500" x 60" x .194 THICKNESS ONE SHEET = 10 STRIPS ONE STRIP = 24 PIECES ONE PIECE = 3.250" x 2.500" x .194 THICKNESS														
10	SHEAR IN STRIPS OF	SHEAR PRESS 80 TON	1	520											
20	BLANK & PIERCE TWO(2) HOLES .380" x .860" - CUT OFF TO LENGTH 2.500"	OBI 125 TON PRESS	1	500	76,950	65,000	1,950	10,000	5,520	460	4,600	460			
30	PLACE IN DRILL FIXTURE AND DRILL ONE (1) .125" HOLE	3.00 RPM MANUAL DRILL PRESS	2	480	.5	6,150	5,000	150	1,000	1,440	120	1,200	120		
40	INSPECT & TRANSFER TO WELD ASSEMBLY AREA														
TOTALS						83,100				6,960					

REMARKS TOTAL: FAC - 83,100) 90,060  
TOOL- 6,960)

Mfg. Development Engrg. & Research	PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.
	HARDWAY	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESIAN	PRODN.	DAILY PLT. PLANNING VOLUME 6,144	24	WELD ASSY	
	INDUSTR. ENGR.						384 PC/HR. 16 HRS.	SUPERSEDES:	

A-238

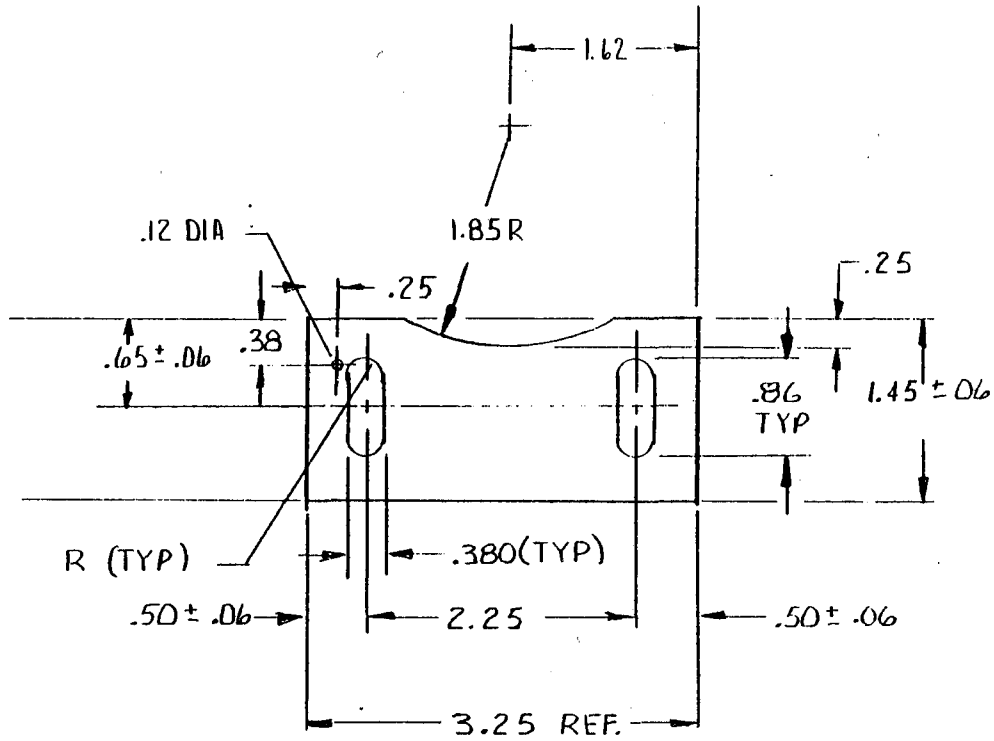


24/ASS'Y

MATERIAL: 6 GA. (1943) STEEL SHEET PER ASTM A-715-75 GRADE 80- ANY AVAILABLE TYPE	A-239
ATTACHMENT BRACKET REFLECTOR PLATE	
277-10119-13-DETAIL-2B3	

**PROCESS ESTIMATE SHEET**

PLANT _____		<b>PROCESS ESTIMATE SHEET</b>						DEPARTMENT _____						
PROGRAM OR ECR NO. HELIOSTAT		PART NAME PLATE ATTACHMENT BRACKET REFLECTOR				ISSUE DATES 9-2-80		PART NO. 277 277-10119-14						
FOR MODELS		MATERIAL ASTM-A-715-GRADE 80		WT./ LBS.	RGH. .266	FIN. .230	RELEASE	SHEET 1 OF 1						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR 'B.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
	MATERIAL: HOT ROLLED STEEL IN SHEETS OF 32.5" x 60" x .194 THICKNESS ONE SHEET = 10 STRIPS ONE STRIP = 40 PIECES ONE PIECE = 1.5" x 3.250" x .194" THICKNESS													
10	SHEAR IN STRIPS OF 3.250" x 60"	SHEAR PRESS 80 TON	1	520	.09									
20	BLANK & PIERCE TWO (2) HOLES .380" x .860" - CUT OFF TO SIZE 1.500"	OBI 125 TON PRESS	1	500	.10	76,950	65,000	1,950	10,000	5,520	460	4,600	460	
30	PLACE IN DRILL FIXTURE AND DRILL ONE (1) .125" HOLE	3,000 RPM MANUAL DRILL PRESS	1	240	.20	3,075	2,500	750	500	720	60	600	60	
40	INSPECT & TRANSFER TO WELD ASS'Y AREA				.10									
	PERSONAL RELIEF				.03									
<b>TOTALS</b>					0.52	80,025				6,240				
REMARKS TOTAL: FAC - 80,025) 86,265 c TOOL- 6,240)														
Mfg. Development Engrg. & Research		PROCESS ENGR. HARDWAY	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME 1664	REQ'D. PER VEHICLE 8	RECHTS. 104 PC/HR. 16 HRS.	NEXT ASSY: WELD ASS'Y	OPER. NO.			



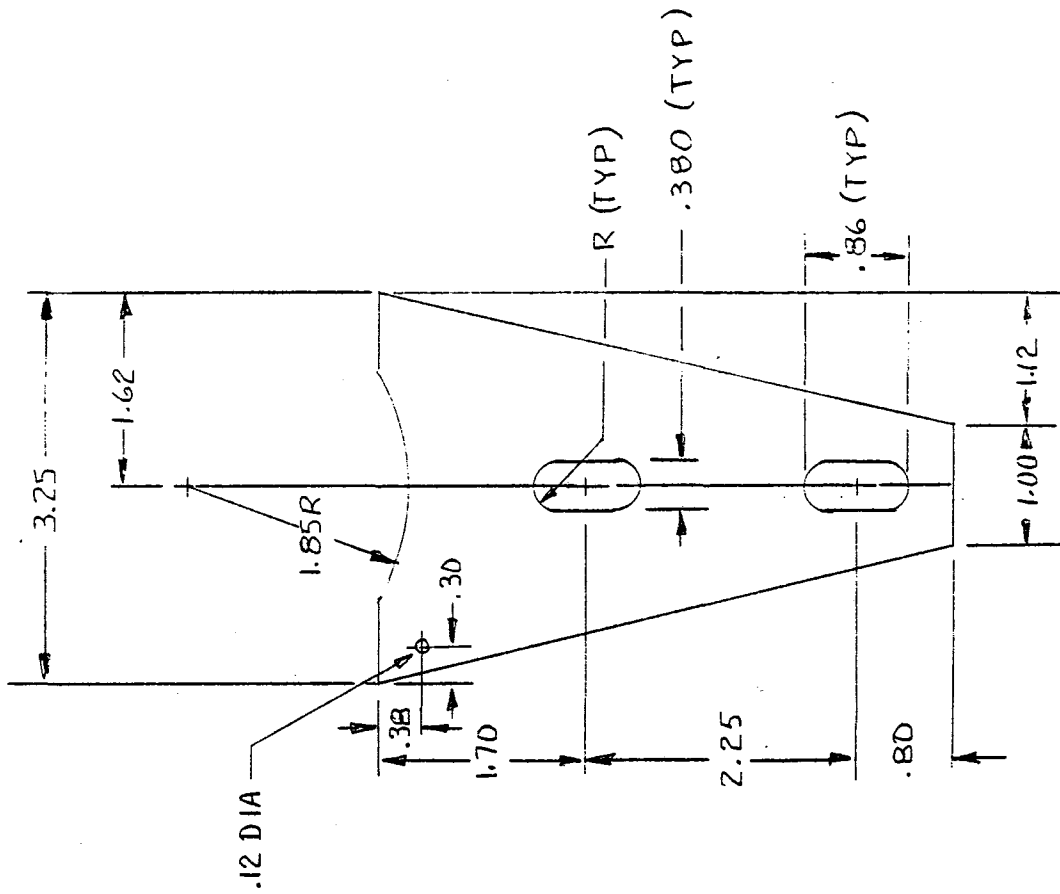
A-241

MATERIAL - 6 GA. 1943 STEEL SHEET PER ASTM A-715-75 - GRADE 80 ANY AVAILABLE TYPE
ATTACHMENT BRACKET REFLECTOR - PLATE 277-10119-14 DETAIL-2R3

**PROCESS ESTIMATE SHEET**

PLANT _____		<b>PROCESS ESTIMATE SHEET</b>						DEPARTMENT _____							
PROGRAM OR ECR NO. HELIOSTAT		PART NAME PLATE-ATTACHMENT BRACKET-REFLECTOR				ISSUE DATES 9-3-80		PART NO. 277-10119-17							
FOR MODELS _____		MATERIAL ASTM-A-715-75 GRADE 80		WT./LBS. .998 .612				RELEASE _____		SHEET 1 OF 1					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. BY/JOY		
	MATERIAL: HOT ROLLED STEEL IN SHEETS OF 35" x 40" x 6 GAGE .194														
10	SHEAR IN STRIPS 3 1/2" x 40" x 10 STRIPS ONE STRIP = 8 PARTS ONE PART = 5" x 3.5" x .194 THICKNESS	SHEAR PRESS 80 TON	1	520		35,900	30,000	900	5,000						
20	BLANK & PIERCE (2) HOLES .380" x .860 - CUT OFF TO SIZE 4.75"	OBI 125 TON PRESS	1	500		76,950	63,000	1,950	10,000	19,950	1,650	16,500	1,800		
30	PLACE IN DRILL FIXTURE AND DRILL ONE (1) .125" HOLE	3,000 RPM MANUAL DRILL PRESS	1	240	.25	3,075	2,500	75	500	720	60	600	60		
40	INSPECT & TRANSFER TO WELD ASSEMBLY AREA														
<b>TOTALS</b>						115,925				20,670					
REMARKS TOTAL: FAC - 115,925) 136,595 TOOL 20,670)															
Mfg. Development Engrg. & Research		PROCESS ENGR. HARDWAY	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	16	NEXT ASSY: WELD ASSEMBLY	OPER. NO.				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESIAN	PRODN.	DAILY PLT. PLANNING VOLUME 3,328	REQMTS. 12 PC/NR. 16 HRS.		SUPERSEDES:					

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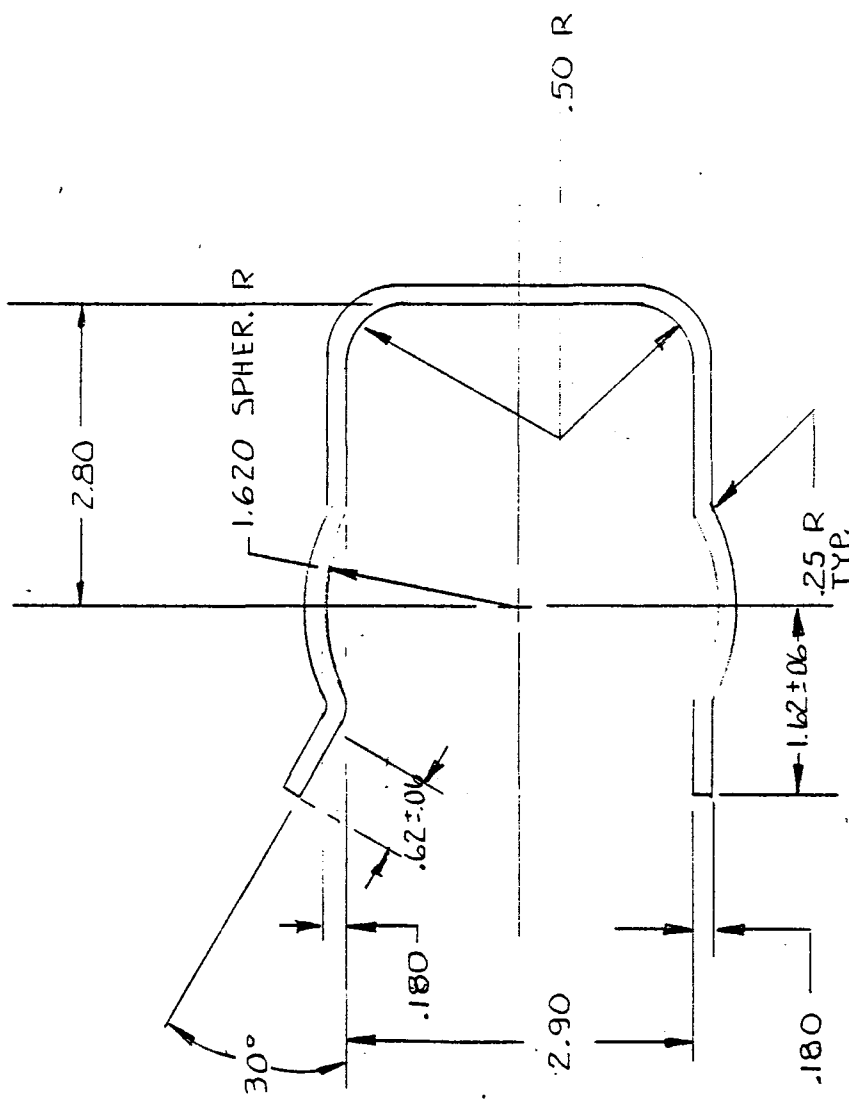


MATERIAL: 6 GA. (1943) STEEL SHEET PER ASTM-A-715-75 GRADE 90 ANY AVAILABLE TYPE	ATTACHMENT BRACKET ELECTRIC TOP PLATE 277-10119-17 DETAIL-C-B
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PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO.		PART NAME			ISSUE DATES		DEPARTMENT								
HELIOSTAT FOR MODELS		a ATTACHMENT BRACKET REFLECTOR			9-3-80		277-10119-18								
MATERIAL		WT./LBS.		RGH. FIN.		RELEASE		SHEET 1 OF 1							
ASTM a-715-75-GRADE-80		2 1,925													
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REVS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INIT. TRYOUT		
	MATERIAL: HOT ROLLED STEEL IN SHEETS OF 36" x 36" x .194" THICKNESS ONE SHEET = 12 STRIPS ONE STRIP = 3 PIECES ONE PIECE = 3" x 12" x .194 THICKNESS														
10	SHEAR IN STRIPS OF 3" x 36"	SHEAR PRESS 80 TON	1	520		35,900	30,000	900	5,000						
20	FORM POCKETS TWO (2) PLACES 1.620" SPHER RAD .180 DEPTH AND FLANGE END 30° SECOND STAGE CUT OFF TO LENGTH 11.750" (DOUBLE DIE)	OBI 150 TON PRESS	1	800		92,400	80,000	2,400	10,000	19,800	1,650	6,500	1,650		
30	FLANGE IN "U" SHAPE	OBI 125 TON PRESS	1	8		92,400	65,000	1,950	10,000	14,400	1,200	2,000	1,200		
40	INSPECT AND TRANSFER TO WELD ASSEMBLY AREA														
TOTALS						220,700				34,200					
REMARKS															
TOTAL: FAC - 220,700) 254,900 TOOL - 34,200)															
Mfg. Development Engrg. & Research		PROCESS ENGR. HARDWAY	PLT. LAYOUT LAB.	AUTOMATION	DESIGN OHANESIAN	MATL. MDLG. ENGR.	PRODN.	DAILY SERVICE	REC'D. PER VEHICLE 48	RECMTS. 624 PC/HR. 16 HRS.	WELD ASS'Y	SUPERSEDES.		OPER. NO.	
		INDUSTRIAL ENGR.		QUAL. CONTR.				DAILY PLT. PLANNING VOLUME 9,984							



MATERIAL - .180 SHEET STEEL PER ASTM A-715-75 GRADE B0	A-245
ATTACHMENT BRACKET REFLECTOR -	
277-10119	DETAIL - B4

11/20/00 13:50:00 1/10/00

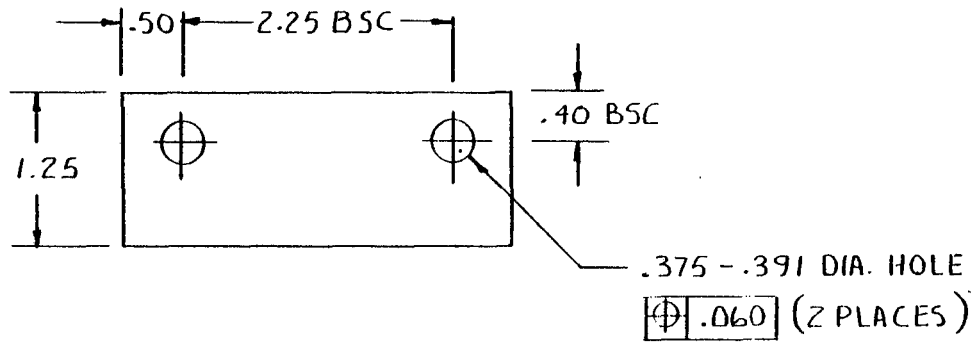
PLANT \_\_\_\_\_

PROCESS ESTIMATE SHEET

DEPARTMENT: \_\_\_\_\_

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PROGRAM OR EER NO. HELIOSTAT FOR MODELS		PART NAME DOUBLER - REINF. PLATE - REFLECTOR				ISSUE DATES 9-3-80			PART NO. 277-10119-19					
		MATERIAL COMMERCIAL QUALITY HOT ROLLED STEEL		WT./ LBS.	RGH. .143	FIN. .135	RELEASE		SHEET		OF			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. BYG/24	
	MATERIAL: COMMERCIAL QUALITY HOT ROLLED STEEL IN SHEETS OF 50" x .125 THICKNESS ONE SHEET = 20 STRIPS ONE STRIP = 40 PIECES ONE PIECE = 1.250 x 3.250													
10	SHEAR IN STRIPS 3 1/4" x 50"	SHEAR PRESS 80 TON	1	520										
20	PIERCE TWO HOLES .375 DIM. & CUT OFF (DOUBLE DIE)	OBI 80 TON PRESS	1	800	41,050	35,000	1,050	5,000	4,320	360	3,600	360		
30	DELIVER TO GALVANIZING													
40	GALVANIZE TO SPEC. PER ASTM A385 - 76 TO 2.00 OZ FT <sup>2</sup>													
50	DELIVER TO H FRAME ASSEMBLY AREA													
<b>TOTALS</b>						41,050			4,320					
<b>REMARKS</b> TOTAL: FAC - 41,050) 45,370 TOOL- 4,320)														
Mfg. Development Engng. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE		REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO.		
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESTAN	PRODN.	DAILY PLT. PLANNING VOLUME	9,984	624	PC/HR.	HRS.			H FRAME



A-247

MATERIAL: 8 GA. (.1644) SHEET STEEL PER ASTM-A-715-75 GRADE B0 ANY AVAILABLE TYPE
ATTACHMENT BRACKET REFLECTOR - DOUBLER 277-10119-10

PROCESS ESTIMATE SHEETSTORQUE TUBE ASSEMBLY/ARM ASSEMBLY

<u>Shop Assembly</u>	SK-6130-002	A-249
Sheet 1-2	Torque Tube Assembly	
<u>Torque Tube</u>	SK-6130-002-2	A-251
Sheet 1	Torque Tube	
<u>Outboard Flange</u>	SK-6130-002-3	A-252
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<u>Inboard Flange</u>	SK-6130-002-4	A-254
Sheet 1-2	Inboard Flange	
<u>Adapter Ring</u>	531439	A-256
Sheet 1-2	Adapter Ring	
<u>Arm Assembly</u>	531147	A-258
Sheet 1-2	Assembly Arm Actuation	
<u>Bracket Arm</u>	531147-1	A-260
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	Detail Sketch	
<u>Brace Cross</u>	531147-2	A-262
Sheet 1	Bracket Actuation Arm Support	
	Detail Sketch	
<u>Brace Cross</u>	531147-3	A-264
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<u>Shop Assembly</u>	531147	A-266
Sheet 1-2	Torque Tube and Actuating Arm Assembly	
<u>Ring Adapter/Swivel Ext.</u>	531439	A-268
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Sheet 3	Plant Engineering Requirements	
	Sequence Sketch	
	Detail Sketch	

PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

DEPARTMENT:

PROGRAM OR EEM NO.		PART NAME			ISSUE DATES			PART NO.							
HELIOSTAT		TORQUE TUBE ASSEMBLY			9-2-80			SK 6130-002							
FOR MODELS		MATERIAL			WT./	RGH.	FIN.	RELEASE		SHEET		OF			
50,000 ANN. VOL.		ASTM A570 GRADE B STEEL			LBS.	271	357			1		2			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRAVEL		
10	PLACE TORQUE TUBE #SK-6130-002-2 IN RING LOADING FIXTURE-LOAD AND LOCATE ADAPTOR RINGS 531439-B-C LOAD AND LOCATE FLANGES INBOARD SK 6130-002-4 TO TORQUE TUBE	SUB-ASS'Y FIXTURE	1	120	.40							1,200	2,000		
20	LOAD WELD ASS'Y FIXTURE WITH FLANGES-OUT BOARD SK 6130-002-3	SEE OPERATION 30		60	.80										
30	LOAD SUB-ASS'Y TORQUE TUBE IN WELD ASS'Y FIXTURE AND LOCK IN AT 6 RING LOCATIONS- START WELD CYCLE AND CORE WELD 3/8 DIM. HOLE AT 20 LOCATIONS PER RING-EQUAL SPACE ON RING FLANGE-UN-LOCK AND REMOVE TORQUE TUBE ASS'Y	WELD ASS'Y FIXTURE	1	24	2.00	26,720	24,000	720	2000	150,000	2,500	125,000	12,500		
40	PLACE TORQUE TUBE ASS'Y IN INSPECTION FIXTURE AND INSPECT WELD AND FLANGE LOCATION		2		IND. LAB	8,000	4,000		4000	14,000	1,200	2,000	1,200		
TOTALS										34,720				164,000	
REMARKS															
SUB-ASS'Y & INSPECTION OPERATION PERFORMED DURING WELD CYCLE															
		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MOLD. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
		HARDWAY													

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR ECR NO. HELIOSTAT FOR MODELS 50,000 ANN. VOL.	PART NAME TORQUE TUBE ASSEMBLY MATERIAL ASTM A570 GRADE B STEEL	ISSUE DATES 9-2-80	PART NO. SK 6130-002 RELEASE SHEET 2 OF 2
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OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRAVEL	
50	DELIVER TO GALVANIZING				IND. LAB									
60	GALVANIZE TO SPEC PER ASTM A385-76 TO 2.00 OZ FT				AUTO									
70	DELIVER TO TORQUE TUBE AND ARM ACTUATION ASS'Y AREA				IND. LAB									
	PERSONAL RELIEF				.21									
<b>TOTALS</b>					<b>3.41</b>									

REMARKS  
WELD BEAD = 3/8" x 3/8" x 45" = 1.78 LBS. TOTAL: FAC - 34,720) 199,120  
TOOL-164,400)

<i>Ford</i> Mfg. Development Engrg. & Research	PROCESS ENGR. HARDWAY	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATH. MDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME 208	REQ'D. PER VEHICLE 1 REQMTS. 13 PC/HR. 16 HRS.	NEXT ASSY: SUPERSEDES:	OPER. NO.

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT

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PROGRAM OR ECR NO.		PART NAME				ISSUE DATES				PART NO.					
HELIOSTAT		TORQUE TUBE				9-2-80				SK 6130-002-2					
FOR MODELS		MATERIAL				WT./		RGM.		EM.		RELEASE		SHEET 1 OF 1	
50,000 ANN. VOL.		ASTM A570 GRADE "B" STEEL				LBS.		271		271					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACH'Y REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRUCK		
	MATERIAL: HOT ROLLED STEEL IN FORMED TUBE SHAPE, WELDED PER AMERICAN WELDING SOCIETY D1-1-79 STRUCTURAL COAD														
	15.3" LONG 15.5 O/D & .105 WALL THICKNESS														
10	RECEIVE TORQUE TUBE FROM STOCK AND PLACE IN TUBE SIZING AREA	3 TON FORK TRUCK	1		IND. LAB	MAT'L HDIG	15,000	450							
20	LOAD TUBE EXPANDER MACHINE AND SIZE TUBE TO 16' O/D IN 5 CONTROLLED LOCATIONS-REMOVE AND PLACE IN INSPECTION PICTURE EST. FLOOR TO FLOOR TIME	BELOW FLOOR MOUNTED 16' GROTHNER TYPE TUBE EXPANDER	1	120	.40	678,000	600,000	8,000	60,000	109,000	10,000	0,000	9,000		
		1/2 TON GIB CRANE ON MARRY-GO-ROUND	3	24	2.00	39,000	21,000	3,000	15,000						
30	INSPECT FOR WELD SEAM DEFECTS-SURFACE FINISH-STRAIGHTNESS WITHIN .375 PER 16' LENGTH-O/D ROUNDNESS .020 - O/D TOLERANCE = .010-LOAD IN SPECIAL RACK AND TRANSPORT TO NEXT OPERATION EST. FLOOR TO FLOOR TIME PERSONAL RELIEF	INSPECTION FIXTURE	@	10	IND. LAB	4,000	2,000		2,000	24,000	2,000	0,000	7,000		
		SPECIAL RACKS	B/R												
TOTALS					16	2,56	721,000			133,000					
REMARKS															
TOTAL: FAC - 721,000) 854,000 TOOL- 133,000)															
	PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. HDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	HEAT ASBY:	OPER. NO.						
	HARDWAY						(1) ONE	WELDING							
	INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLTY. PLANNING VOLUME	REQ'D. 13	SUPERSEDES:							
	S. LEWIS			OHANESIAN			PC/HR. 16								

McG. Development Engr. & Research

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PROGRAM OR PIR NO. HELIOSTAT	PART NAME OUT BOARD FLANGE	ISSUE DATES 9-2-80	PART NO. SK 6130-002-3
FOR MODEL 50,000 ANN. VOL.	MATERIAL ASTM-A570 GRADE B STEEL	WT./ RGH. FM. LBS. 14.3 13.3	RELEASE SHEET 1 OF 2

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DEMER	BUILD	INST. TRYOUT	
	MATERIAL: HOT ROLLED EXTRUDED MTL SECTION & RAISED 90 ATTACHMENT RING .425" x 1.5" - PURCHASED IN 100" LENGTH													
10	CUT TO 50" LENGTH INSPECT AND TRANSPORT TO COILER MACHINE	CUT OFF SAW	1	120	.40					SAME AS USED FOR PART 531 439-A				
20	LOAD COILER MACHINE AND FORM RING OF 15,500" O/D W/REVERSED 90 FLANGE	RING TYPE COILER MACHINE	1	120	.40	SAME AS 531 439-A (NEW ROLLERS REQUIRED)				9,600	800	8,000	800	
30	LOAD RING WELDER AND FUSION WELD RING ENDS - TRANSFER TO SIZING	RING TYPE FUSION WELDER	1	120	.40	SAME AS 531 439-A (NEW WELD LEAD REQUIRED)				2,400	200	2,000	200	
40	LOAD TUBE EXPANDER MACHINE AND SIZE RING TO 15.770 = .005 O/D - TRANSFER TO LATHE MACHINE	RING EXPANDER MACHINE	1	120	.40	SAME AS 531 439-A (NEW SIZING TOOLING)				3,600	300	3,000	300	
<b>TOTALS</b>										15,600				

REMARKS

Mfg. Development Engrg. & Research	PROCESS ENGR. HARDWAY	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.
	INDUSTR. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESIAN	PRODN.	DAILY PLT. PLANNING VOLUME	26 PC/HR.	TORQUE TUBE ASS'Y SUPERSEDES:	

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PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

PROGRAM OR ECR NO. HELIOSTAT		PART NAME OUT BOARD FLANGE			ISSUE DATES 9-2-80		DEPARTMENT PART NO. SK 6130-002-3							
FOR MODELS 50,000 ANN. VOL.		MATERIAL ASTM-A570 GRADE B STEEL			WT./ LBS.	RGH. 14.3	FM. 13.3	RELEASE		SHEET 2 OF 2				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	MST. BYOUT	
50	LOAD LATHE AND FACE 425" DIM-CLEAN UP ONE PASS TO .375" = .005 - TRANSFER TO DRILLING MACHINE	AIR CHUCK & FACE LATHE	1	120	.40		SAME AS	USED FOR PART		531 439-A				
60	LOAD MULTIPLE HEAD DRILLING MACHINE - DRILL 24 HOLES FOR 1.4 20 UNC IAP HOLES - TRANSFER TO TAP MACHINE	24 CHUCK MULTIPLE HEAD DRILL MACHINE 14.900" BSC	1	40	1.20	66,800	60,000	1,800	5,000	30,000	2,500	5,000	2,500	
70	LOAD MULTIPLE HEAD TAPPING MACHINE - TAP 24 HOLES WITH 1/4" 20 UNC TAP-ONE PASS	24 CHUCK MULTIPLE HEAD TAPPING MACHINE 14.900" BSC		40	1.20	66,800	60,000	1,800	4,000	36,000	3,000	0,000	3,000	
80	INSPECT ALL MACHINE SURFACES AND TRANSFER TO ASS'Y AREA  PERSONAL RELIEF	GAGES			IND. LAB  .29					10,000				
<b>TOTALS</b>					4.69	133,600				76,000				
REMARKS TOTAL: FAC - 133,600) 225,200 TOOL- 91,600)														
Mfg. Development Engrg. & Research		PROCESS ENGR. HARDWAY	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PRDGN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME	REQ'D. PER VEHICLE 2 REQMTS. 26 PC/HR.	NEXT ASSY: TORQUE TUBE ASS'Y SUPERSEDES:	OPER. NO.				

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PROCESS ESTIMATE SHEET

PROGRAM OR CTR NO. HELIOSTAT		PART NAME INBOARD FLANGE			ISSUE DATES 9-2-80		PART NO. SK 6130-002-4									
FOR MODELS 50,000 ANN. VOL.		MATERIAL ASTM-A570 GRADE B STEEL			WT./LBS.	PRG. 14.3	FIN. 13.3	RELEASE	SHEET 1 OF 2							
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'Y REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST		
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT			
	MATERIAL: HOT ROLLED EXTRUDED MILL SECTION W/RING BASE 4" x .125" & RAISED 90° ATTACHMENT RING .425" x 1.5" PURCHASED IN 100" LENGTH															
10	CUT TO 50" LENGTH INSPECT AND TRANSPORT TO COILER MACHINE	CUT OFF SAW	1	120	.40			SAME AS USED FOR PART	531 439-A							
20	LOAD COILER MACHINE AND FORM RING OF 15 1/2" O/D - TRANSFER TO WELDER	RING TYPE COILER MACHINE	1	120	.40			SAME AS USED FOR PART	531 439-A							
30	LOAD RING WELDER AND FUSION WELD RING ENDS- TRANSFER TO SIZING	RING TYPE FUSION WELDER	1	120	.40			SAME AS USED FOR PART	531 439-A							
40	LOAD TUBE EXPANDED MACHINE AND SIZE RING TO 16.010 INCH I.D. + or - .005 - MACHINE	RING EXPANDER MACHINE	1	120	.40			SAME AS USED FOR PART	531 439-A							
TOTALS																
REMARKS																
Mfg. Development Engrg. & Research		PROCESS ENGR. HARDWAY INDUSTR. ENGR. S. LEWIS	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR. OHANESIAN	MATL. MDLG. ENGR. PRDGN.	DAILY SERVICE 416 DAILY PLT. PLANNING VOLUME	REQ'D. PER VEHICLE 2 REQMTS. 416 PC/HR.	16 HRS.	NEXT ASSY: TORQUE TUBE ASS'Y SUPERSEDES:	OPER. NO.					

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PLANT FORD AEROSPACE

**PROCESS ESTIMATE SHEET**

DEPARTMENT \_\_\_\_\_

PROGRAM OR ECR NO. HELIOSTAT		PART NAME INBOARD FLANGE				ISSUE DATES 9-2-80		PART NO. SK 6130-002-4							
FOR MODELS 50,000 ANN. VOL.		MATERIAL ASTM-A570 GRADE B STEEL		WT./ LBS. 14.3	RGH. 13.3			RELEASE	SHEET 2	OF 2					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TBYCAT		
50	LOAD LATHE AND FACE .425 DIM. - CLEAN UP ONE PASS TO .375 + or - .005 - TRANSFER TO DRILLING MACHINE	AIR CHUCK A FACE LATHE	1	120	40					SAME AS USED FOR PART	531 439-A				
60	LOAD MULTIPLE HEAD DRILLING MACHINE - DRILL 24 CLEARANCE HOLES FOR 1/4 NC BOLT	24 CHUCK MULTIPLE HEAD DRILL MACHINE 17.100" BSC	1	40	1.20					SAME AS USED FOR PART	531 439-A				
70	INSPECT ALL MACHINE SURFACES AND TRANSFER TO ASS'Y AREA	INSPECTION FIXTURE	1	60	IND LAB					SAME AS USED FOR PART	531 439-A				
	PERSONAL RELIEF				.21										
TOTALS					3.41										
REMARKS TOTAL: FAC - 0) 0 TOOL- 0)															
		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
		HARDWAY INDUSTRIAL ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	416 DAILY PLT. PLANNING VOLUME	2 REQMTS.	TORQUE TUBE ASS'Y SUPERSEDES:						
							416 PC/NR.	16 HRS.							

Mfg. Development  
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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT

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PROGRAM OR CER NO. HELIOSTAT		PART NAME ADAPTOR RING				ISSUE DATES 9-2-80				DEPARTMENT PART NO. 531439-A					
FOR MODELS 50,000 ANN. VOL.		MATERIAL ASTM A570 GRADE B STEEL				WT./ LBS. 14.3				RELEASE SHEET 1 OF 2					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				DEPEND. COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRNG/AT		
1	MATERIAL: HOT ROLLED EXTRUDED MILL SECTION W/RING BASE 4" x .125 & RIASED 90° ATTACHMENT RING .425 x 1.5 - PURCHASED IN 100" LENGTHS														
10	CUT TO 50" LENGTH INSPECT AND TRANSPORT TO COLLER MACHINE	CUT OFFSSAW	1	120	.40	20,540	18,000	540	2,000						
20	LOAD COLLER MACHINE AND FORM RING OF 15 1/2 " OLD-TRANSFER TO WELDER	RING TYPE COLLER MACHINE	1	120	.40	154,200	140,000	4,200	10,000						
30	LOAD RING WELDER AND FUSTON WELD RING ENDS TRANSFER TO SIZING	RING TYPE COIL, FUSTION WELDER		120	.40	41,050	34,000	1,050	5,000						
40	LOAD TUBE EXPANDER MACHINE AND SIZE RING TO 16.010" I/D + or - .005" TRANSFER TO LATHE MACHINE	RING EXPANDER MACHINE		120	.40	92,400	80,000	2,400	10,000						
TOTALS						308,190									
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR. HARDWAY	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR. OHANESIAN	MATL. MDLG. ENGR.	PRODN.	DAILY SERVICE 416	DAILY PLY. PLANNING VOLUME	REQ'D. PER VEHICLE 2	REMTS. 416 PC/HR.	16	NRL	NEXT ASSY: TORQUE TUBE ASS'Y	OPER. NO.

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT

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PROGRAM OR CTR NO. HELIOSTAT		PART NAME ADAPTOR RING				ISSUE DATES 9-2-80				PART NO. 531439-A			
FOR MODELS		MATERIAL ASTM-A570 GRADE B STEEL				WT./ LBS. 14.3		RGH. FIN. 13.3		RELEASE		SHEET 2 OF 2	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR D.T. NUMBER	MACHS REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			
						TOTAL	BASIC	FREIGHT	INSTAL- LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT
50	LOAD LATHE AND FACE .425 DIM-CLEAN UP ONE PASS TO .375 + or - .005 TRANSFER TO DRILLING MACHINE	AIR CHUCK & FACE LATHE	11	120	.40	24,660	22,000	660	2,000	7,200	1,200	6,000	
60	LOAD MULTIPLE HEAD DRILLING MACHINE- DRILL 12 CLEARANCE HOLES FOR 5/16 NC BOLTS	24 CHUCK MULTIPLE HEAD DRILL MACHINE 17.100" BSC		40	1.20	66,800	60,000	1,800	5,000				
70	INSPECT ALL MACHINE SURFACES AND TRANSFER TO ASS'Y AREA	INSPECTION FIXTURE	1		IND. LAB	2,000	1,000		1,000	8,750	1,050	7,000	700
	PERSONAL RELIEF				.21								
TOTALS					3.41	93,460				15,950			
REMARKS TOTAL: FAC - 401,650) 417,600 TOOL- 15,950)													
	PROCESS ENGR. HARDWAY	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE 416	REQ'D. PER VEHICLE 2	NEXT ASSY: TORQUE TUBE ASS'Y		OPER. NO.			
Mfg. Development Engrg. & Research						DAILY PLT. PLANNING VOLUME	REQDTS. 416 PC/HR.	16	HRS.		SUPERSEDES:		

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT: 58

PROGRAM OR PPN NO. HELIOSTAT	PART NAME ASSEMBLY ARM TORQUE TUBE ACTUATION	ISSUE DATES 9-6-80	PART NO. 531147 ASS'Y A
FOR MODELS 50,000 ANN. VOL.	MATERIAL AS LISTED IN PART PROCESS	WT./ LBS. 40.26	RGH. 40.26
		FIN.	RELEASE SHEET 1 OF 2

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	TEST	
10	OBTAIN ARM ACTUATION #431147 DET 1 FROM STOCK-PLACE IN WELD FIXTURE AND LOCATE WITH PINS AT 3" DIA. HOLE AND 8.38 DIA RAD RT & LT CLOSE CLAMPS	WELD ASSEMBLY FIXTURE	1		.30	4,500	2,000	500	2,000	20,625	2,475	16,500	1,650	
	OBTAIN C/M SUPPORT #531147 DET 2 FROM STOCK PLACE IN WELD FIXTURE AND CLAMP TOP & BOTTOM				.20									
	OBTAIN C/M SUPPORT # 531147 DET 3 FROM STOCK PLACE IN WELD FIXTURE AND CLAMP TOP & BOTTOM				.20									
	OBTAIN END CAP #431147 DET 4 FROM STOCK PLACE IN WELD FIXTURE AND CLAMP				.20									
TOTALS						4,500				20,625				

REMARKS

PROG. ENGR. HARDWAY	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY: TORQUE TUBE	OPER. NO. 10
INDUSTR. ENGR. S. LEWIS	LAD.	QUAL. CONTR.	PLT. ENGR. OHANESIAN	PRODN.	DAILY PLT. PLANNING VOLUME 208	REQ'TS. 13 PC/NR. 16 HRS.	SUPERSEDES:	

Mfg. Development Engrg. & Research

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

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PROGRAM OR ECR NO. HELIOSTAT		PART NAME ASSEMBLY ARM TORQUE TUBE ACTUATION				ISSUE DATES 9-6-80		DEPARTMENT 531147 ASS'Y							
FOR MODEL 95,000 ANN. VOL.		MATERIAL AS LISTED IN PART PROCESS				WT./ LBS.	RGH. 40.26	FIN. 40.26	RELEASE		SHEET 2 OF 2				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL- LATION	TOTAL	DESIGN	BUILD	INST. BYG/27		
20	WELD COMPLETE PER AMERICAN WELDING SOCIETY D 1.1-79 STRUCTURAL WELDING CODE	AUTOMATIC FEED WELDING MACHINES	2	20	2.40	17,420	14,000	420	3,000						
25	DELIVER GALVANIZING				GAL. SYST.										
30	GALVANIZE TO SPEC. PER ASTM A385-76 TO 2.00 OZ FT <sup>2</sup>				"										
35	DELIVER TO TORQUE TUBE AND ARM ACTUATION ASS'Y AREA				IND, LAB.										
	PERSONAL RELIEF				.22										
<b>TOTALS</b>					3.52	17,420									
REMARKS WELD BEAD = 1/8" x 1/8" x 58" = .252 lbs. TOTAL: FAC - 21,920) 42,545 TOOL- 20,625)															
PROCESS ENGR. HARDWAY		PLT. LAYOUT LAB.		AUTOMATION QUAL. CONTR.		DESIGN PLT. ENGR.		MNTL. HDLG. ENGR. PRDGN.		DAILY SERVICE DAILY PLT. PLANNING VOLUME 208		REQ'D. PER VEHICLE 1 REQMTS. 13 PC/HR. 16 HRS.		NEXT ASSY: TORQUE TUBE SUPERSEDES:	

Mfg. Development  
Engr. & Research

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PLANT FORD AEROSPACE

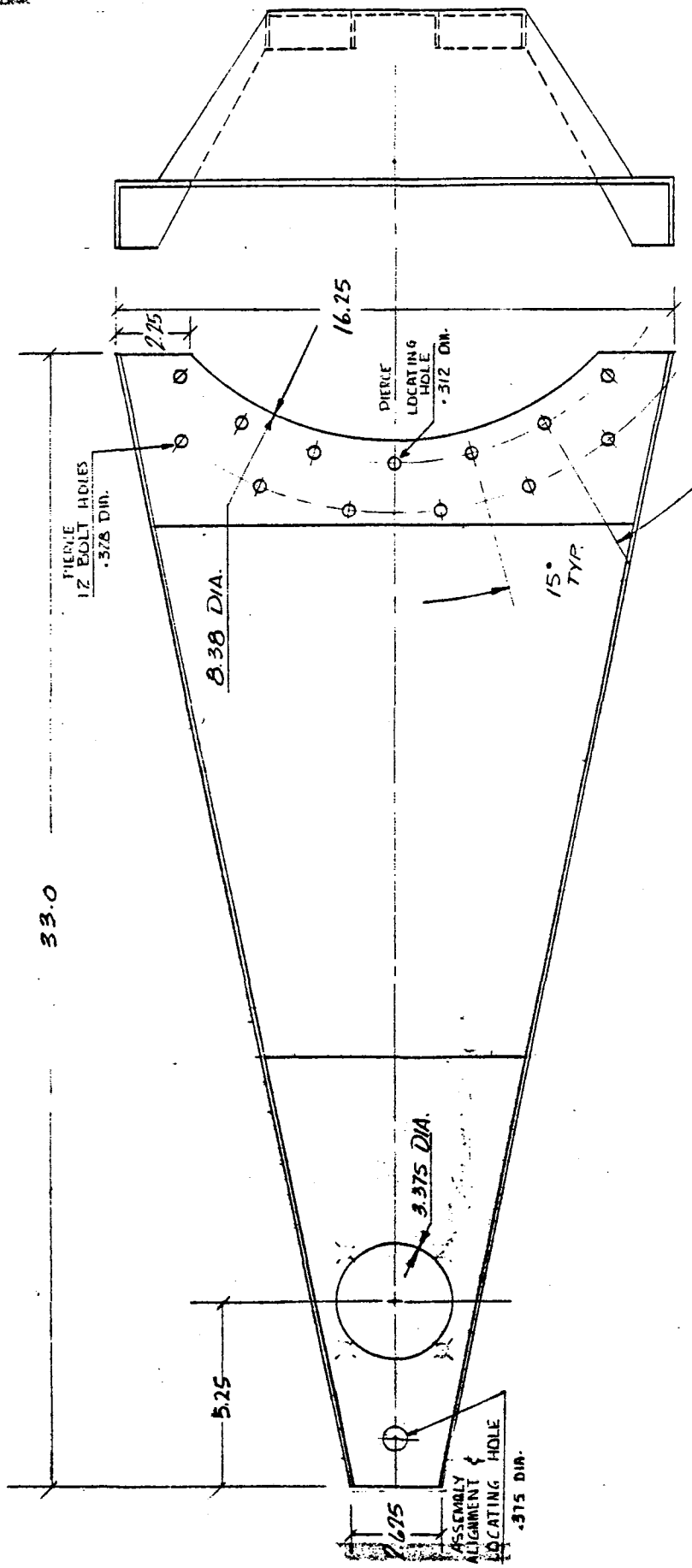
PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR CER NO. HELIOSTAT		PART NAME BRACKET ARM-TORQUE TUBE ASS'Y				ISSUE DATES 9-5-80		PART NO. 531147 DETAIL 1							
FOR MODELS 50,000 ANN. VOL.		MATERIAL ASTM-A-715-75-GRADE 80 H/R		WT./ 33,20 LBS.		H. 17.92		RELEASE		SHEET 1 OF 1					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. (BY CAT)		
	MATERIAL: HOT ROLLED SHEET STEEL IN SHEETS OF 42" x 80" x .134" THICKNESS 10 GAGE ONE SHEET = 4 PARTS														
10	SHEAR IN SHEET SIZE 22" x 40"	SHEAR PRESS 80 TON	1	500	.10										
20	TRIM TO DEVELOPED BLANK	500 TON SINGLE ACTION PRESS	1	500	.10	311,600	280,000	6,600	25,000	55,200	4,600	4,000	4,600		
30	PRE-BEND & FLANGE COMPLETE	500 TON SINGLE ACTION PRESS	1	500	.10					43,200	3,600	36,000	3,600		
40	PERCE 12 HOLE PATTERN 5/16 BOLT CLEARANCE & 5 HOLE PATTERN W/3.00" DIA. UNDERSIZED HOLE AT WING	500 TON SINGLE ACTION PRESS	1	500	.10					24,480	2,040	20,400	2,040		
50	DRY-TRVER TO WELD ASS'Y AREA														
	PERSONAL RELIEF				.03										
<b>TOTALS</b>					0.43	311,600				122,880					
<b>REMARKS</b> TOTAL: FAC - 311,600) 434,480 TOOL- 122,880)															
Mfg. Development Engr. & Research		PROCESS ENGR. HARDWAY	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY: WELD ASS'Y		OPER. NO.				
		INDUSTR. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESIAN	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. 26 PC/HR. 16 HRS.	SUPERSEDES:						

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59



TORQUE TUBE ASSY  
 53/147  
 STAMPED PART LEFT A  
 FIG. 4 LEFT  
 DETAIL 1  
 J. CHAMBERS

60

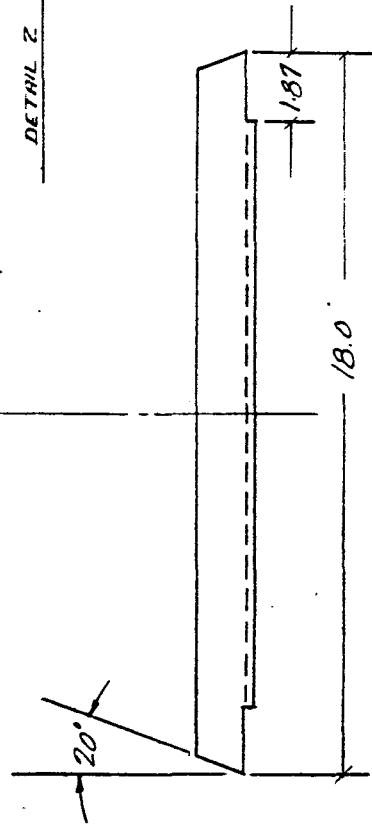
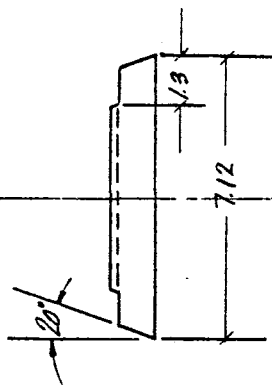
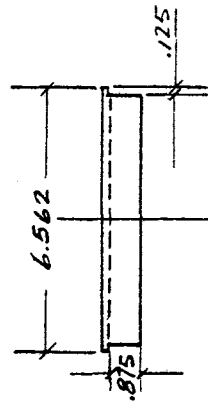
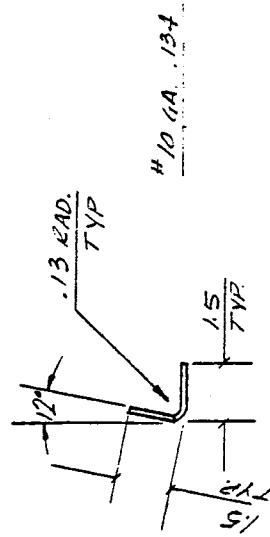
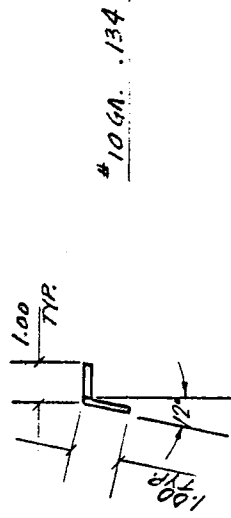
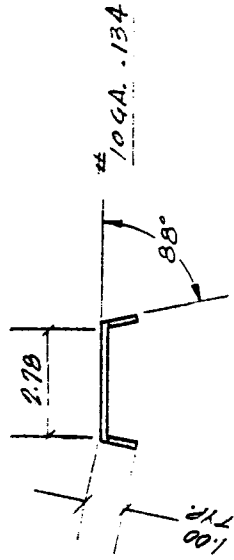
FORD AEROSPACE

PROCESS ESTIMATE SHEET

PLANT		PROGRAM OR SER NO. A HELIOSTAT					PART NAME BRACKET ACTUATION ARM SUPPORT			ISSUE DATES 9-6-80		DEPARTMENT 531147 DETAIL 2			
FOR MODELS 50,000 ANN. VOL.		MATERIAL ASTM A-715-75-GRADE 80 H/R			WT./LBS.	RGH.	FIN.	RELEASE		SHEET 1 OF 1					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYS/CT		
	MATERIAL: USE OFFAL FROM PART # 531147 DETAIL 1 - ANGLE CUT														
10	SHEAR IN BLANK SIZE 18.375" x 3" (3 HITS)	SHEAR PRESS 80 TON	1	200	.24		SAME AS	USED FOR PART		531147 DETAIL 4					
20	TWO STAGE NOTCH & FLANGE	500 TON SINGLE ACTION PRESS	1	500	.10		SAME AS	USED FOR PART 531147 DET. 1	11,040	920	9,200	920			
30	DELIVER TO TORQUE TUBE ACTUATION ARM WELD- ASS'Y AREA				IND. LAB										
	PERSONAL RELIEF				.02										
TOTALS					0.36				11,040						
REMARKS TOTAL: FAC - 0 ) TOOL- 11,040 ) 11,040															
PROCESS ENGR. HARDWAY		PLT. LAYOUT		AUTOMATION		DESIGN		MATL. MDLG. ENGR.		DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:	
INDUSTR. ENGR.		LAB.		QUAL. CONTR.		PLT. ENGR. OLANESTIAN		PRODM.		DAILY PLT. PLANNING VOLUME 416		REQMTS. 26 PC/HR. 16 HRS.		WELD ASS'Y SUPERSEDES:	
Mfg. Development Engrg. & Research															

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BRACKET ARM 531147  
TORQUE TUBE ASSY  
WHEELDRIVE



PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

61

PROGRAM OR ZER NO. HELIOSTAT		PART NAME BRACKET ACTUATION ARM SUPPORT				ISSUE DATES 9-6-80		PART NO. 531147 DETAIL 3							
FOR MODELS 50,000 ANN. VOL.		MATERIAL ASTM A-715-75- GRADE 80 H/R		WT./LBS.	RGH. .47	FIN. .43	RELEASE	SHEET 1 OF 1							
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'Y REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	MST. TRVOLT		
	MATERIAL: USE AFFLE FROM PART # 531147 DETAIL 1 - ANGLE CUT														
10	SHEAR IN BLANK SIZE 6.250" x 2" (3 HITS)	SHEAR PRESS 80 TON	1	200	.24	SAME AS USED FOR PART 531147 DET 4									
20	TWO STAGE NOTCH & FLANGE	500 TON SINGLE ACTION PRESS	1	500	.10	SAME AS USED FOR PART 531147 DET 1				5,750	480	1,800	480		
30	DELIVER TO TORQUE TUBE ACTUATION ARM WELD ASS'Y AREA				IND. LAB										
	PERSONAL RELIEF				.02										
TOTALS					.36					5,760					
REMARKS TOTAL: FAC - 0 ) TOOL- 5,760) 5,760															
Mfg. Development Engrg. & Research		PROCESS ENGR. HARDWAY	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	2	WELD ASS'Y	OPER. NO.				
		INDUSTRY ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESIAN	PRODN.	DAILY PLT. PLANNING VOLUME	416	26 PC/NR.	16 HRS.					

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

62

PROGRAM OR EEN NO. HELIOSTAT		PART NAME BRACKET ARM REINE TORQUE TUBE ASS'Y				ISSUE DATES 9-6-80		PART NO. 531147 DETAIL 4						
FOR MODELS 50,000 ANN. VOL.		MATERIAL ASTM A-715-75 GRADE 80 H/R		WT./ LBS. 1.08	RGH. FIN. .660	RELEASE		SHEET 1 OF 1						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTAL- LATION	TOTAL	DESIGN	BUILD		INST. TRVGT
	MATERIAL: USE AFFAL FROM PART # 531147 DETAIL 1 8.38 RAD CUT OUT													
10	SHEAR IN BLANK SIZE 6." x 4.78 (3 HITS)	SHEAR PRESS 80 TON	1	200	.34	35,900	30,000	900	5,000					
20	TWO STAGE NOTCH &	500 TON SINGLE ACTION PRESS	1	500	.10		SAME AS 531147	USED FOR DET 1		9,360	780	7,800	780	
30	DELIVER TO TORQUE TUBE ACTUATION ARM WELD - ASS'Y AREA													
	PERSONAL RELIEF				.02									
TOTALS					.36	35,900				9,360				
REMARKS TOTAL: FAC - 35,900) 45,260 TOOL- 9,360)														
		PROCESS ENGR. HARDWAY	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE		REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO.		
		INDUSTY. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESIAN	PRODM.	DAILY PLT. PLANNING VOLUME 208		1	WELD ASS'Y				
									13 PC/HR.	16 HRS.				

Mfg. Development  
Engr. & Research

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PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO. HELIOSTAT	PART NAME TORQUE TUBE & ACTUATING ARM ASS'Y	ISSUE DATES 9-6-80	DEPARTMENT PART NO. 531147 ASS'Y
FOR MODELS 90,000 ANN. VOL.	MATERIAL AS LISTED IN PART PROCESS	WT. LBS. 422.66	SGM. 430
		RELEASE	SHEET 1 OF 2

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. REQS.	
10	OBTAIN RING ADAPTOR FORK RT & LT PART # 531439-B FROM STOCK - PLACE IN ASSEMBLY FIXTURE AND SECURE WITH 1.000" DIA. LOCATING PINS TWO (2) PLACES	ASSEMBLY FIXTURE W/BORING ATTACHMENT	1		.60	4,500	2,000	500	2,000	42,000	3,500	35,000	3,500	
20	OBTAIN TORQUE TUBE ASS'Y PART # SK6130-002 FROM STOCK - PLACE IN ASSEMBLY FIXTURE AND CLOSE GATE CLAMPS	BRIDGE RAIL - HOIST SPECIAL ADAPTOR HOOK			2.00									
30	SECURE RING ADAPTOR FORKS TO TORQUE TUBE ASSEMBLY WITH 5/16" BOLTS EIGHT (8) PLACES	PNEUMATIC PISTOL GRIP NUT RUNNER - BOX END WRENCH			1.20					1,000				
<b>TOTALS</b>						4,500				43,000				

REMARKS

PROCESS ENGR. HARDWAY	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.
INDUSTR. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMYS.	FIELD	10
Mfg. Development Engrg. & Research					208	13 PC/NR. 16 NR.	SUPERSEDES:	

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR EPR NO. HELIOSTAT	PART NAME TORQUE TUBE & ACTUATION ARM ASS'Y	ISSUE DATES 9-8-80	DEPARTMENT PART NO. 531147 ASS'Y
FOR MODELS 50,000 ANN. VOL.	MATERIAL AS LISTED IN PART PROCESS	WT./ LBS. 422.66	RCM. 430
		RELEASE	SHEET 2 OF 2

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
40	OBTAIN ARM (R & L) TORQUE TUBE ACTUATION ASS'Y PART # 531147 FROM STOCK - PLACE IN ASSEMBLY FIXTURE - CLAMP AND BOLT RING ADAPTOR FORKS, TORQUE TUBE ASSEMBLY AND ARM TORQUE TUBE ACTUATION ASSEMBLY TOGETHER WITH 5/16" BOLTS NUTS & WASHERS (24) LOCATIONS	PNEUMATIC PISTOL GRIP NUT RUNNER BOOK END WRENCH			4.20										
50	LINE BORE TWO 3.000" DIA HOLES TO 3.250" IN ARM ACTUATION ASSEMBLY WITH FIXTURE MOUNTED BORING HEAD				1.50										
60	RELEASE ALL CLAMPS AND INSPECT IN FREE POSITION	GAGE FOR 29.000" D.M. CHECK			.50					2,500					
70	REMOVE TORQUE TUBE AND ACTUATION ARM ASS'Y FROM FIXTURE				.50										
80	TRANSPORT TO FIELD SHIPPING AREA				IND. LAB										
	PERSONAL RELIEF				.70										
TOTALS					11.20					2,500					

REMARKS: TOTAL: FAC - 4,500) 50,000  
TOOL- 45,500)

PROCESS ENGR. HARDWAY	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.
INDUSTY. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR. OHANRESTAN	PRODN.	DAILY PLT. PLANNING VOLUME 208	REQMTS. 13 PC/HR. 16 HRS.	FIELD SUPERSEDES:	10

Mfg. Development  
Engr. & Research

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PROCESS ESTIMATE SHEET

PROGRAM OR P.C.R. NO.		PART NAME				ISSUE DATES				DEPARTMENT				
HELIOSTAT		RING ADAPTOR SWIVEL EXT. L.H. & R.H.				8/27/80				PART NO. 531439-B				
FOR MODELS		MATERIAL STEEL CASTING				WT./ RGH. FIN. LBS.				RELEASE		SHEET 1 OF 3		
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACH'Y REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TOYCAT	
5	RECEIVING INSPECTION-CASTINGS	GAGES								2000				
10	ROUGH MILL SLOT & OUTER FACE (2)/CYCLE	HORIZ. MILL W/ARBOR	1	38	1.25	99,000	90,000	2,000	7,000	35,000				
	EST. F TO F - 2.0 MIN/ (2) PARTS	REF. K. & T. OR CTNN.)												
20	R. & F. MILL ATTACHMENT SURFACE - (2)/CYCLE	VERTICAL (2) SPDL MILL	1	38	1.25	132,000	120,000	2,000	10,000	25,000				
		(REF. K. & T. OR (WN)												
	(16° ANGLE REVERSED FOR OPPOSITE HANDS)													
	EST. F. TO F. - 20 MIN/(2) PARTS.													
TOTALS						231,000				62,000				
REMARKS														
Mfg. Development Engng. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATI. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
INDUSTR. ENGR. S. LEWIS		LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	16 EA PC/HR.	(1)L.H. & (1)R.H.	SUPERSEDES:					
								16 hrs.						

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PROCESS ESTIMATE SHEET

PLANT		PROGRAM OR PPR NO.						PART NAME				ISSUE DATES		DEPARTMENT			
		HELIOSTAT						RING ADAPTOR SWIVEL EXT. L.H. & R.H.				8/27/80		531439-B			
FOR MODELS		MATERIAL						WT./LBS.		RGH. FIN.		8/27/80		RELEASE		SHEET 2 OF 3	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST			
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INIT. TRYOUT				
30	DRILL, CHAMFER & REAM (1) 1,000 DIA. TRUNNION HOLE & (7) BOLT ATTACHMENT HOLES SPOTFACE (7) HOLES - 1 FW. MILL SLOT -EST. F. TO F. - 1.0 MW./2 PARTS	(6) STA. ROTARY DRILL MACHINE	1	76	0.63	330,000	300,000	5,000	25,000	130,000							
40	WASH & DRY MONORAIL	AVAIL															
45	FINAL INSPECTION	BENCH W/LIGHTS GAGES				1,000			1,000	10,000							
	TRANSPORT TO TORQUE TUBE ASSY AREA																
	PERSONAL RELIEF				0.21												
TOTALS					3:34	331,000				140,000							
REMARKS																	
		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:		OPER. NO.				
		INDUSYR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME		REQM'TS. PC/HR. HRS.		SUPERSEDES.						

Mfg. Development  
Engrg. & Research

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PROCESS ESTIMATE SHEET

PROGRAM OR EER NO. FORD AEROSPACE		PART NAME RING ADAPTOR-SWIVEL EXT. L.H. & R.H.				ISSUE DATES		DEPARTMENT PART NO. 531439-B						
FOR MODELS HELIOSTAT		MATERIAL PLANT ENGINEERING REQUIREMENTS			WT./ LBS.	QTY.	FM.	RELEASE	SHEET 3 OF 3					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQ.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. BY COST	
1	CHIP-COOLANT AND CLARIFICATION SYSTEM					20,000	15,000		5,000					
2	COOLANT REFRIGERATION SYSTEM													
3	EXHAUST - FUME - DUST AND VENTILATION													
4	CO2 FIRE PROTECTION SYSTEM													
5	MONORAIL CONVEYORS	200'				40,000	20,000		20,000					
6	MONORAIL CARRIERS (TOOLING)	50 ON 4'C								10,000				
7	ROLLER CONVEYOR					3,000	2,000		1,000					
8	POWERED CONVEYORS													
9	PLATFORMS - STILES													
10	SERVICE RAILS AND HOISTS													
11	TOOL CABINETS-RACKS AND STANDS					1,000	500		500					
12	TOOL CONTROL BOARDS													
13	WORK-GAGING AND INSPECTION TABLES					2,000	1,000		1,000					
14	PARTS BASKETS (EXPENSE)	150 @ \$50												7,500
15	PRODUCTION AIDS-ASSEMBLY AIDS	TILT STANL				1,500	1,000		500					
16	SECONDARY LIGHTING													
17	PROGRAMMABLE CONTROLLERS													
18	AUTOMATION - PART HANDLING SYSTEM													
19	ENGINEERING SERVICES DESIGN-(EXPENSE)													2,000
20	BUILDING SERVICES - UTILITIES													
21	POWER AND FREE CONVEYOR SYSTEM													
22	POWER AND FREE CONVEYOR CARRIERS (TOOLING)													
23	MACHINE FOUNDATIONS AND DECKS													
24	PLANT REARRANGEMENT (EXPENSE)													
25	MATERIALS HANDLING - RACKS-CONTAINERS-DUNNAGE													
	BUILDING CONSTRUCTION	1200 SQ. FT.												
TOTALS						67,500				10,000				9,500
REMARKS: TOTALS: FAC - 629,500 } 851,000 TOOLS- 212,000 } EXP. 9,500 }														
Mfg. Development Engr. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. HDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMYS. PC/HR. HRS.	SUPERSEDES:					

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OPER. 30  
(9) STA. ROTARY  
MILLS, DRILL & REAM

OPER. 10  
HORIZ.  
DISTANCE  
MILL

OPER. 10  
HORIZ.  
MILL

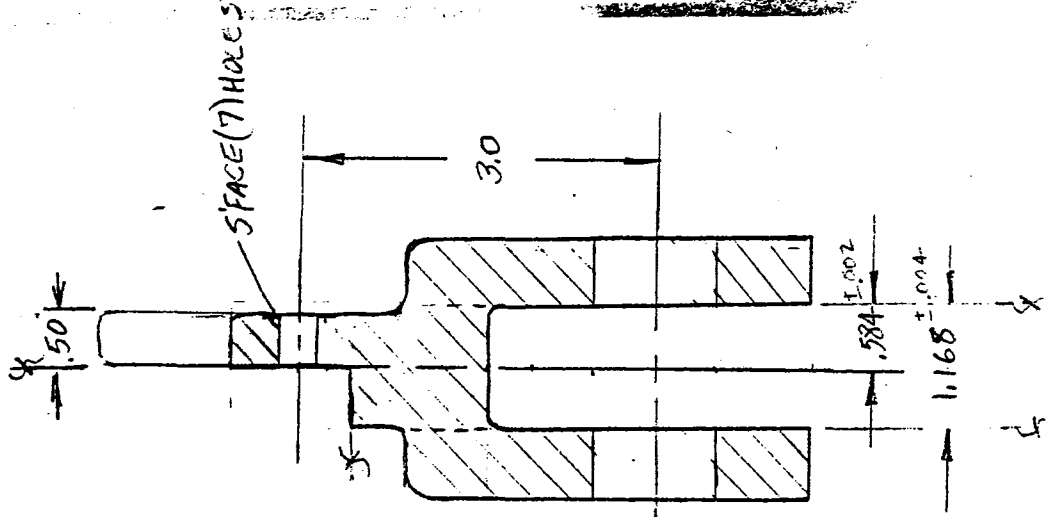
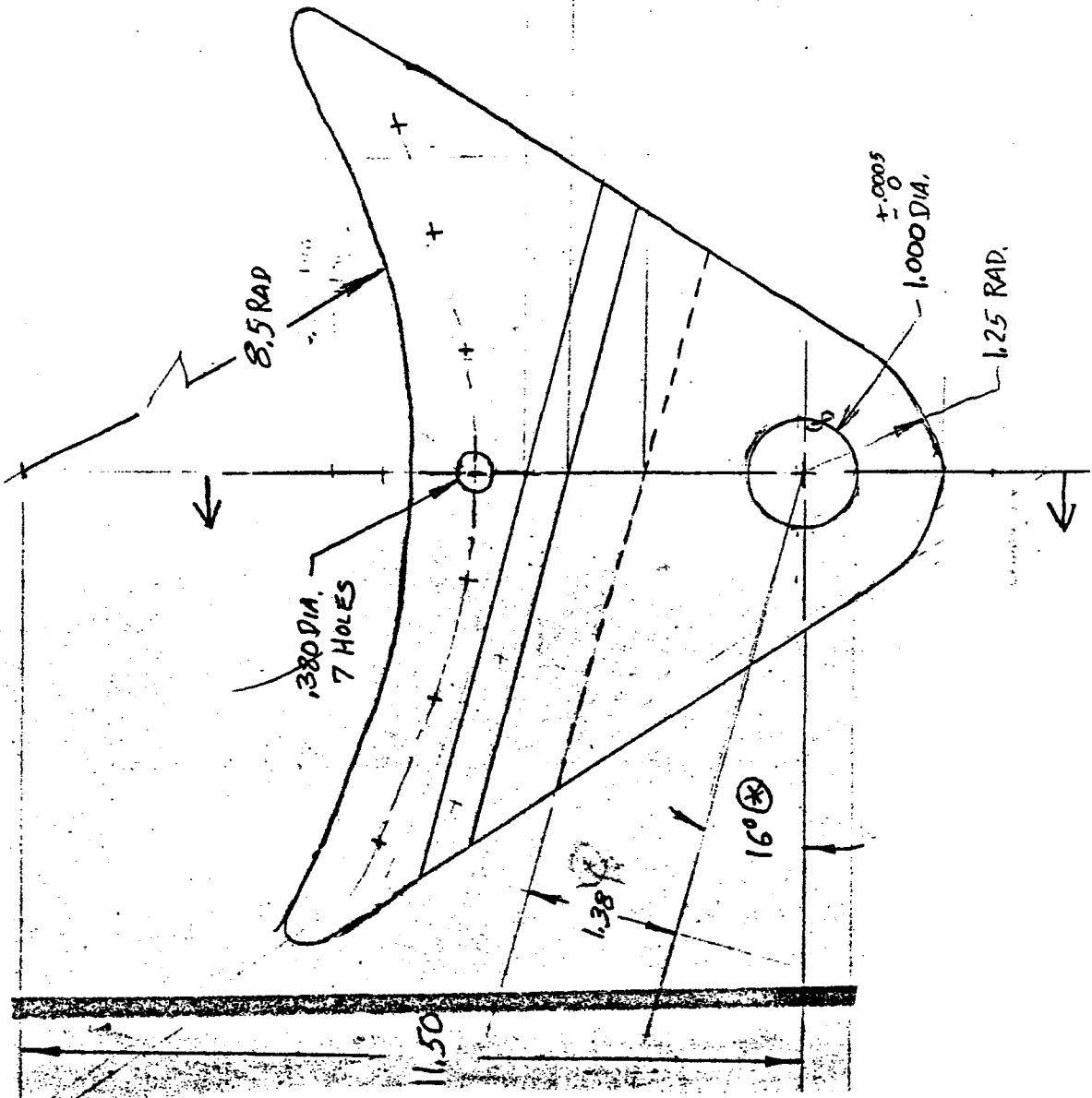
531439-B  
RING ADAPTOR SWIVEL EXT., L.H. & R.H.

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531439-B  
 RING ADAPTOR SWIVEL EXT. - L.H.A  
 R.H.  
 STEEL CASTING

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(\*) 16° SLOT REVERSED  
 FOR OPP. HAND



PROCESS ESTIMATE SHEETSGIMBAL/ACTUATOR DETAIL ITEMS

<u>Elevation Drive Trunnion</u>	531442-01	A-274
Sheets 1-2	Adapter - Elevation Drive Trunnion	
Sheet 3	Plant Engineering Requirements	
Sequence Sketch		
<u>Elevation Bearing Pin</u>	531442-16	A-278
Sheet 1	Pin - Elevation Bearing	
Sheet 2	Plant Engineering Requirements	
<u>Elevation Actuator Pivot</u>	531442-17	A-280
Sheet 1	Pin - Elevation Actuator Mount Pivot	

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PROCESS ESTIMATE SHEET

PLANT		PROGRAM OR CTR NO. HELIOSTAT						PART NAME ADAPTER-EL. DRIVE TRUNNION				ISSUE DATES 9/8/80		DEPARTMENT					
FOR MODELS		MATERIAL STAINLESS STEEL FORG. 302/304						WT./LBS. 10.0		RGM		FIN.		PART NO. 531442-01		RELEASE		SHEET 11 OF 3	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST					
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TOY/GAT						
05	RECEIVE FORGING (NOT PIERCED)																		
10	ROUGH & SEMI-FIN. TURN FACE, DRILL & COREDRILL.	(6) STA. HORIZ. CHUCKER		26	1.89	163,000	150,000	3,000	10,000	40,000									
	EST. F. TOF. - 1.50 MIN	GAGES								1,000									
20	FIN. GRIND DIA. A & ADJ. SHOULDER	ANGLE SLIDE GRINDER		48	1.00	142,000	130,000	2,000	10,000	15,000									
	EST. F. TO F - .80 MIN	GAGES								3,000									
TOTALS						305,000				58,000									
REMARKS																			
Mfg. Development Engrg. & Research		PROCESS ENGR. H. GOVE	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.									
		INDUSTY. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESIAN	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. 26 PC/HR. 6 HRS.	SUPERSEDES:										

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**PROCESS ESTIMATE SHEET**

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PLANT _____		<b>PROCESS ESTIMATE SHEET</b>								DEPARTMENT _____				
PROGRAM OR ECR NO. HELIOSTAT		PART NAME ADAPTER - EL. DRIVE TRUNNION						ISSUE DATES		PART NO. 531442-01				
FOR MODELS		MATERIAL				WT./LBS.	RGH.	FIN.	RELEASE	SHEET 2 OF 3				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD		INST. TRYG.
30	FIN. BORE 2.750/2.751 I.D. EST. F. TO F. - .70 MIN.	S.S. PRECISION BORE MACH GAGES	1	55	0.88	66,000	60,000	1,000	5,000	15,000				
										2,000				
40	DRILL (4) .44 DIA HOLES THRU FLANGE EST. F. TO F. - .60 MIN	S.S. VERT. DRILL PRESS W/MULTI-SPDL HEAD  GAGES	1	64	0.75	34,000	30,000	1,000	3,000	80,000				
										400				
50	PASSIVATE PER ASTM A-380 OR QQ-P-35													
60	INSPECT & PACKAGE FOR SHIPMENT PERSONAL RELIEF													
TOTALS					4.85	100,000				25,400				
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMYS.	SUPERSEDED:					
								PC/HR.	HRS.					

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PROCESS ESTIMATE SHEET

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PLANT \_\_\_\_\_ DEPARTMENT \_\_\_\_\_

PROGRAM OR ECH. NO. **HELIOSTAT** PART NAME **ADAPTOR - ELEVATION DRIVE TRANSMISSION** ISSUE DATES **9-10-80** PART NO. **531442-01**

FOR MODELS \_\_\_\_\_ MATERIAL PLANT ENGINEERING REQUIREMENTS WT./ LBS. \_\_\_\_\_ QTY. \_\_\_\_\_ FIN. \_\_\_\_\_ RELEASE \_\_\_\_\_ SHEET **3 OF 3**

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQD.	NET HOURLY CAP.	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. (BY VENDOR)	
1	CHIP - COOLANT AND CLARIFICATION SYSTEMS					64000	40000	4000	20000					
2	COOLANT REFRIGERATION SYSTEM													
3	EXHAUST - FUME - DUST AND VENTILATION													
4	CO2 FIRE PROTECTION SYSTEM													
5	MONORAIL CONVEYORS	100'				20000	10000		10000					
6	MONORAIL CARRIERS (TOOLING)	25								5000				
7	ROLLER CONVEYOR	50'				4000	2500		1500					
8	POWERED CONVEYORS													
9	PLATFORMS - STILES													
10	SERVICE RAILS AND HOISTS													
11	TOOL CABINETS - RACKS AND STANDS					1000	500		500					
12	TOOL CONTROL BOARDS													
13	WORK - GAGING AND INSPECTION TABLES					2000	1000		1000					
14	PARTS BASKETS (EXPENSE)													1000
15	PRODUCTION AIDS - ASSEMBLY AIDS													
16	SECONDARY LIGHTING													
17	PROGRAMMABLE CONTROLLERS													
18	AUTOMATION - PART HANDLING SYSTEM													
19	ENGINEERING SERVICES DESIGN - (EXPENSE)													2000
20	BUILDING SERVICES - UTILITIES													
21	POWER AND FREE CONVEYOR SYSTEM													
22	POWER AND FREE CONVEYOR CARRIERS (TOOLING)													
23	MACHINE FOUNDATIONS AND DECKS													
24	PLANT REARRANGEMENT (EXPENSE)													
25	MATERIALS HANDLING - RACKS - CONTAINERS - DUNNAGE					2000	1500		500					
	BUILDING CONSTRUCTION	1500 SQ. FT.				93000				5000				3000

TOTALS: FAC. - 493,000  
 TOOLING - 28,400  
 EXP. - 3,000  
**\$581,400**

PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MOLD. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	KEY ASSY.	OPER. MGR.
INDUS. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODH.	DAILY PLT. PLANNING	RECMTC.	SUPPLIERS	

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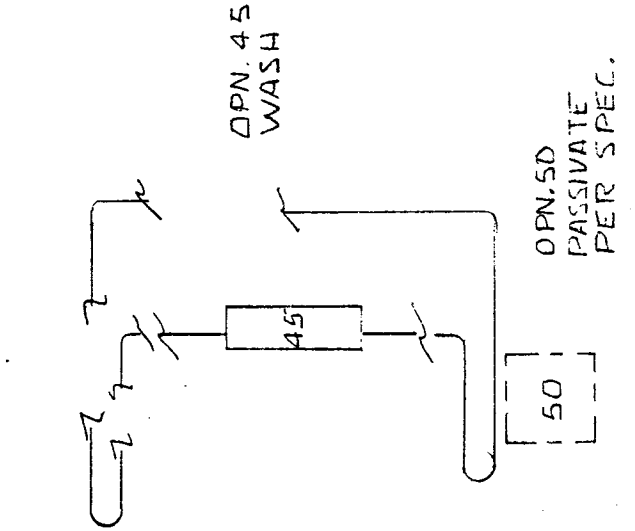
OPN. 20  
ANGLE SLIDE  
DRILL

OPN. 30  
PRECISION  
BORE

OPN. 40  
WASH

OPN. 50  
PASSIVATE  
PER SPEC.

OPN. 60  
FINAL INSPECT.



AREA - 1800 SQ. FT.

ADAPTER-ELEVATION  
DRIVE TRUNNION

531442-01

**PROCESS ESTIMATE SHEET**

5's

PLANT WORD AEROSPACE

DEPARTMENT \_\_\_\_\_

PROGRAM OR PART NO. HELIOSTAT	PART NAME PTN-RT. BEARING	ISSUE DATES 9-8-80	PART NO. 531442-16
FOR MODELS 50,000 ANN. VOL.	MATERIAL 304 STAINLESS BAR	WT./LBS. <u>.52</u> RGH. FIN.	RELEASE _____ SHEET <u>1</u> OF <u>2</u>

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
05	RECEIVE BAR STOCK APPROX. 1.03 DIA													
10	CHAMFER, GROOVE & CUT-OFF (2)/ CYCLE	AUTO. BAR MACH.		43	1.13	77,000	70,000	2,000	5,000	15,000				
	EST. F. TO F. - .90 MM	GAGES								4,000				
20	SEMI-FIN. & FIN. C/LISS GRIND	C/LISS GRINDER (AVAIL. FROM 835234-9)		384	.13					1,000				
	(2) PASSES	GAGES								3,000				
	EST. F. TO F. - .10 MIN.													
25	PASSIVATE PER ASTM A380 OR QQ-P-35													
30	FINAL INSPECT. & PACKAGE				TND, LAB									
	PERSONAL RELIEF				.08									
<b>TOTALS</b>						1.34	77,000			23,000				

REMARKS \_\_\_\_\_

Mfg. Development Engrg. & Research	PROCESS ENGR. H. GOVE	PLT. LAYOUT	AUTOMATION	DESIGN	MAT'L. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.
	INDUSTRY ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESTAN	PRODN.	DAILY PLT. PLANNING VOLUME	REQM'TS. 26 PC/HR. 16 HRS.	SUPERSEDES:	

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PROCESS ESTIMATE SHEET

PROGRAM OR PROJ. NO.		PART NAME				ISSUE DATES				DEPARTMENT					
		FIN - EL. BEARING				7-8-80				PART NO. 531442-16 (85)					
FOR MODELS		MATERIAL				WT./ LG.				RELEASE					
		PLANT ENGINEERING REQUIREMENTS				RGH. FIN.				SHEET 2 of 2					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST					
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. COST		
1	CHP - COOLANT AND CLARIFICATION SYSTEMS					31,000	20,000	1,000	10,000						
2	COOLANT REFRIGERATION SYSTEM														
3	EXHAUST - FUME - DUST AND VENTILATION														
4	GCE FIRE PROTECTION SYSTEM														
5	MONORAIL CONVEYERS														
6	MONORAIL CARRIERS (TOOLING)														
7	ROLLER CONVEYOR														
8	POWERED CONVEYERS														
9	PLATFORMS - STIES														
10	SERVICE RAILS AND HOISTS														
11	TOOL CABINETS - RACKS AND STANDS					1,000	500		500						
12	TOOL CONTROL BOARDS														
13	WORK - GAGING AND INSPECTION TABLES					1,000	500		500						
14	PARTS BASKETS (EXPENSE)												1,000		
15	PRODUCTION AIDS - ASSEMBLY AIDS														
16	SECONDARY LIGHTING														
17	PROGRAMMABLE CONTROLLERS														
18	AUTOMATION - PART HANDLING SYSTEM														
19	ENGINEERING SERVICES DESIGN - (EXPENSE)												1,000		
20	BUILDING SERVICES - UTILITIES														
21	POWER AND FREE CONVEYOR SYSTEM														
22	POWER AND FREE CONVEYOR CARRIERS (TOOLING)														
23	MACHINE FOUNDATIONS AND DECKS														
24	PLANT REARRANGEMENT (EXPENSE)														
25	MATERIALS HANDLING - RACKS - CONTAINERS - DURNAGE					3,000	2,500		500						
TOTALS						36,000							2,000		
REMARKS TOTAL: FAC - 113,000 TOOL - 23,000 138,000 EXP. - 2,000															
PROCESS ENGR.		PLT. LAYOUT		AUTOMATION		DESIGN		MACH. HDLS. ENGR.		DAILY SERVICE		METHS. PER VEHICLE		NEXT ASSY:	

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT: \_\_\_\_\_

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PROGRAM OR CER NO. HELIOSTAT	PART NAME PTN-EL, ACT. MOUNT PIVOT	ISSUE DATES	PART NO. 531442-17
FOR MODELS 50,000 ANN. VOL.	MATERIAL 304 STAINLESS	WT./LBS. .21	RGH. FIN.
		RELEASE	SHEET 1 OF 1

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRVOLT	
05	RECEIVE BAR STOCK APPROX. 1.03 DTA. (SAME AS 531442-16)													
10	CHAMFER, GROOVE & CUT-OFF (2)/CYCLE	AUTO. BAR MACH.		43	1.12					4,000				
		(AVAIL. FROM 531442-16 PTN-EL. BEARING)												
	EST. P. TO F. - .90 MIN.	GAGES								2,000				
	CHANGE-OVER TIME - (1) HOUR													
20	SEMI-FIN & FIN. C'LESS	C'LESS GRINDER		384	.13									
		(AVAIL. FROM 531442) 16 PTN-EL. BEARING)												
	(2) PASSES													
	EST. P. TO F. - .10 MIN.	SYNPRON FEEDER TOOLING								4,000				
25	PASSIVATE PER ASTM A380 OR QQ P-35													
30	FINAL INSPECT & PACKAGE				IND. LAB									
	PERSONAL RELIEF				.08									
<b>TOTALS</b>					1.33					10,000				

REMARKS TOTAL: FAC - 0  
TOOL - 10,000 } 10,000  
EXP. - 0

	PROCESS ENGR. H. GOVE	PLT. LAYOUT	AUTOMATION	DESIGN	MATH. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE 1	NEXT ASSY:	OPER. NO.
	INDUSTR. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESJAN	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. 13 PC/HR. 16 HRS.	SUPERSEDES:	

*Ford* Mfg. Development Engrg. & Research

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PROCESS ESTIMATE SHEETSATTACHMENTS FOR WIRING AND SENSORS

<u>Bracket, Wiring Support</u>	531442-24	A-282
Sheets 1-2	Bracket, Azimuth Cable Wrap	
<u>Mount for Sensor P.C. Boards</u>	531442-06	A-284
Sheets 1-2	Mount, PC Board (Az and E1)	
<u>Adapter, Sensor</u>	531442-02	A-286
Sheets 1-2	Adapter for Motor Revolution Counter (Az)	
<u>Sleeve, Sensors</u>	531442-01	A-288
Sheets 1-3	Sleeve - Motor Revolution Counter (Az and E1)	
Sheet 4	Plant Engineering Requirements	
Sequence Sketch		
<u>Adapter, Sensor</u>	531442-04	A-293
Sheets 1-2	Adapter for Motor Revolution Counter (E1)	
<u>Cover for Sensor</u>	531442-05	A-295
Sheets 1-3	Cover for Motor Revolution Counter	
<u>Adjuster for Sensors</u>	531442-08	A-298
Sheet 1	Adjuster, PC Board (Az and E1)	
Sheet 2	Plant Engineering Requirements	
<u>Mount for Reference Sensors</u>	531442-10	A-300
Sheets 1-2	Mount, Zero Reference Sensor (Az)	
<u>Holder for Reference Sensor</u>	531442-11	A-302
Sheets 1-2	Holder, Zero Reference Sensor (Az and E1)	
Sheet 3	Plant Engineering Requirements	
Sequence Sketch		
<u>Mount for Reference Sensor</u>	531442-13	A-306
Sheets 1-3	Mount, Zero Reference Sensor (E1)	
<u>Bracket for Sensor (E1)</u>	531442-14	A-309
Sheets 1-2	Bracket, Magnet Holder, Zero Reference Sensor (E1)	
<u>Bracket for Sensor (Az)</u>	531442-15	A-311
Sheets 1-2	Bracket, Magnet Holder, Zero Reference Sensor (Az)	

PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT

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PROGRAM OR PART NO. HELIOSTAT	PART NAME BRACKET, AZ CABLE WRAP	ISSUE DATES 9-10-80	PART NO. 531442-24
FOR MODELS 50,000 ANN. VOL.	MATERIAL ASTM A-36 STEEL	WT./LBS. 11.41	RELEASE SHEET 1 OF 2

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. REPLY	
	MATERIAL: ASTM A-26 STEEL IN L SHAPE 3" x 6" x 1/2" THICKNESS IN LENGTH OF 36" = 6 PARTS													
10	SAW IN 6" LENGTH 6 PARTS PER BAR- TRANSFER TO NEXT OPERATION	DO-ALL TYPE AUTOMATIC BAND SAW	1	60	.80	EXISTING # 531442-13								
20	PLACE IN DRILL FIXTURE & DRILL ONE (1) 1.4" HOLE, DRILL ON SAME PLANE TWO (2) 7/16" HOLE - ROTATE 90° & DRILL TWO (2) .25" HOLES - TRANSFER TO NEXT OPERATION	BENCH DRILL PRESS GAGES	1	40	1.20	EXISTING #531442-13				1,800	150	1,500	150	
										500				
30	PLACE IN MILLING INDEXING FIXTURE AND 8" SIDES ON 10° - INDEX & MILL 6" BASE TO 2.0" WIDTH- INDEX AND MILL .5" ARM AT .7" RAD ON 3° WITH 1/4" x 45° CHAMFER- TRANS. TO NEXT OPERATION	#3 MILLING MACHINE GAGES	1	20	2.40	24,600	21,000	630	3,000	5,400	450	4,500	450	
										1,000				
<b>TOTALS</b>						24,600				8,700				

REMARKS

Mfg. Development Engr. & Research	PROCESS ENGR. HARDWAY	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE 1	NEXT ASSY: FINAL	OPER. NO.
	INDUSTR. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESIAN	PRODN.	DAILY PLT. PLANNING VOLUME 208	REQMTS. 13 PC/HR. 16 HRS.	SUPERSEDES:	

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR ECR NO. HELIOSTAT		PART NAME BRACKET, AZ CABLE WRAP			ISSUE DATES 9-10-80		DEPARTMENT: PART NO. 531442-24								
FOR MODELS 50,000 ANN. VOL.		MATERIAL ASTM A-36 STEEL			WT./ LBS. 11.41	RGH. FIN.	RELEASE		SHEET 2 OF 2						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQ.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
40	HOT DIP GALVANIZE PER ASTM A-153-73 TO 1.00 TO 1.25 OZ-FT <sup>2</sup> TRANSFER TO FINAL ASSEMBLY AREA				GAL. SYST										
	PERSONAL RELIEF				.29										
TOTALS					4.69										
REMARKS TOTAL: FAC - 24,600 TOOL- 8,700 } 33,300 EXP - 0 }															
Mfg. Development Engg. & Research		PROCESS ENGR. HARDWAY	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MOLDG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY: FINAL		OPER. NO.				
		INDUSYR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS.	SUPERSEDES:						
							208	1	13PC/HR. 16 HRS.						

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

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DEPARTMENT:

PROGRAM OR ECR NO. HELICSTAT		PART NAME MOUNT. PC BOARD, AZ & EL				ISSUE DATES 9-9-80		PART NO. 531442-06						
FOR MODELS 50,000 ANN. VOL.		MATERIAL AL51- 1020 STEEL		WT./ LBS. .30		FIN.		RELEASE		SHEET 1 OF 2				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD		INST. TRYOUT
	MATERIAL: AL51 - 1020 STEEL BAR 1 1/16" x 40" x 1/2" THICKNESS ONE BAR = 20 PARTS													
10	SAW IN 2" LENGTH THREE PARTS PER PASS - TRANSFER TO NEXT OPERATION	DO-ALL TYPE AUTOMATIC	1	180	.27		EXISTING	# 531442-13						
20	PLACE IN 20 PIECE MACHINING FIXTURE 10 LOCATION FOR .625" ARBOR TYPE MILLING CUTTER - ROTATE 90° AND MILL 1.200" SLOT TEN (10) PARTS - TRANSFER TO NEXT OPERATION	# 3 VERTICAL MILL WITH ARBOR ATTACHMENT	1	240	.20	26,660	22,000	660	3,000	3,120	260	2,600	260	
30	LOCATE IN DRILL FIXTURE AND DRILL TWO (2) HOLES .185" DIA - COUNTER BORE ONE (1) LOCATION .500" BY .031 DEPTH - DRILL TWO (2) HOLES FOR #4 - 40 VNC - 2 B TAP - TRANSFER TO NEXT OPERATION	BENCH DRILL PRESS	2	30	1.60	5,650	5,000	150	500	2,160	180	1,800	180	
TOTALS						32,310				5,280				
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR. HARDWAY	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO.			
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESTAN	PRODN.	DAILY PLT. PLANNING VOLUME	26	2	FINAL				
							416	26 PC/HR.	16	HRS.				

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PLANT FORD AEROSPACE

**PROCESS ESTIMATE SHEET**

DEPARTMENT: \_\_\_\_\_

PROGRAM OR ECR NO. HELIOSTAT	PART NAME MOUNT. PC BOARD AZ & EL	ISSUE DATES 9-9-80	PART NO. 53142-06
FOR MODELS 50,000 ANN. VOL.	MATERIAL A151-1020 STEEL	WT./LBS. .30	RGH. FIN.
		RELEASE	SHEET 2 OF 2

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'Y REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	
40	GALVANIZE PER SPECS. AGTM A-153-73 TO 1.00 TO 1.25 OZ.-FT <sup>2</sup> - TRANSFER TO NEXT OPERATION				GAL. SYST								
50	BENCH - MANUAL REAM .190" HOLE TWO (2) LOCATION & TAP TWO (2) HOLES TO #4-40 UNC 2B THREAD SIZE - ASSEMBLY AREA	HAND TOOLS	1	30	1.60	2,000	1,000		1,000	50		50	
	PERSONAL RELIEF				.25								
<b>TOTALS</b>						3.92	2,000			50			

REMARKS  
TOTAL: FAC - 34,310) 39,640  
TOOL - 5,330)

PROCESS ENGR. HARDWAY	PLY. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLY. ENGR.	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLY. PLANNING VOLUME 4 16	REQ'D. PER VEHICLE 2 26 PC/HR.	NEXT ASSY: FINAL SUPERSEDES:	OPER. NO.
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Mfg. Development  
Engg. & Research

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PROCESS ESTIMATE SHEET

PROGRAM OR CER NO. HELTOSTAT		PART NAME ADAPTOR MOTOR REV COUNTER. AZ				ISSUE DATES 9-9-80		DEPARTMENT PART NO. 531442-02							
FOR MODELS 50,000 ANN. VOL.		MATERIAL A151-1020 STEEL		WT./ LBS.	RGH. 1.00	FIN.	RELEASE	SHEET 1 OF 2							
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTAL- LATION	TOTAL	DESIGN	BUILD	INST. SERVING		
	MATERIAL: A151 1020 SHEET STEEL 31" x 31" x .250 THICKNESS CUT INTO 8 STRIPS OF 3.875" x 31" ONE STRIP = 8 PARTS														
10	SHEAR SHEET STEEL INTO EIGHT (8) EQUAL STRIPS OF 3.875" x 31" TRANSFER TO NEXT OPERATION	100 TON SHEAR PRESS	1	600	.08	73,860	62,000	1,860	10,000						
20	FIRST STAGE PIERCE 1.75 DIA HOLE - SECOND STAGE BLANK DISC OF 3.87 DIA - TRANSFER TO NEXT OPERATION	500 TON SINGLE ACTION PRESS	1	600	.08		EXISTING #531147			USE TOOLING FROM PART 531442-05					
30	PLACE IN CHUCK AND TURN O/D TO 3.19 DIA .06 DEEP - TRANSFER TO NEXT OPERATION	FACE LATHER GAGES	1	240	.20		EXISTING #531443								
TOTALS						73,860				500					
REMARKS															
Mfg. Development Engr. & Research		PROCESS ENGR. HARDWAY	PLT. LAYOUT LAB.	AUTOMATION	DESIGN OHANESTIAN	MATL. MDLG. ENGR.	PRODN.	DAILY SERVICE	DAILY PLT. PLANNING VOLUME 208	REQ'D. PER VEHICLE 1	RECMTS. 13 PC/HR. 16 HRS.	NEXT ASSY: FINAL	SUPERSEDES:	OPER. NO.	

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PLANT FORD AEROSPACE

**PROCESS ESTIMATE SHEET**

DEPARTMENT: \_\_\_\_\_

PROGRAM OR ECR NO. HELIOSTAT		PART NAME ADAPTOR MOTOR REV COUNTER, AZ			ISSUE DATES 9-9-80		PART NO. 531442-02			
FOR MODELS 50,000 ANN. VOL.		MATERIAL A151-1020 STEEL		WT./ LBS.	RGH. 1.06	FIN.	RELEASE		SHEET 2 OF 2	

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. BYG./YR	
40	PLACE IN DRILL FIXTURE	BENCH DRILL	1	120	.40		EXISTING	#277	10119-14	2,160	180	1,800	180	
	BACK TO BACK TWO (2)													
	PARTS - DRILL .201 HOLE													
	FOUR (4) PLACES - DRILL													
	.31 HOLE FOUR PLACES -	GAGES								500				
	TRANSFER TO NEXT OPERATION													
50	HOT DIP GALVANIZE PER													
	SPRC. ASFM A153073 1.00													
	TO 1.25 OZ/FT <sup>2</sup> - TRANS													
	TO FINAL ASS'Y													
	PERSONAL RELIEF				.05									
					TOTALS	0.81				3,160				

REMARKS  
TOTAL: FAC - 73,860  
TOOL - 3,160) 77,020

	PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.
	HARDWAY						1	FINAL	
	INDUSTR. ENGR.	LAD.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQ'TS.	SUPERSEDES:	
						208	13 PC/HR. 16 HRS.		

*Stow* Mfg. Development Engrg. & Research

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PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO. HELIOSTAT		PART NAME SLEEVE-MOTOR REV COUNTER, AZ & EL				ISSUE DATES 9-8-80			DEPARTMENT PART NO. 531442-01						
FOR MODEL 50,000 ANN. VOL.		MATERIAL A151 1020 STEEL TUBING			WT./ LBS.	QTY.	FIN.	RELEASE	SHEET 1 OF 4						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRAVEL		
05	RECEIVE A151 1020 STEEL TUBING - 3 7/8 OD x 3/8 WALL														
10	CUT-OFF TO LENGTH EST. F. TO F. - .80 MIN.	ABRASIVE CUT-OFF (AVAIL.)		48	1.00	FROM 885235-7				1,000					
20	FINISH FACE TO LENGTH & BORE DIA. A TO .19 DEPTH EST. F. TO F. - .60 MIN.	S.S. CHUCKER LATHE (AVAIL.-FROM) T.B.D.	1	64	75	FROM 531442-01				2,000					
30	DRILL (4) HOLES FOR #10-32 TAP - BOTH ENDS (LOAD DRILL, REVERSE PART, DRILL, UNLOAD) EST. F. TO F. 1.0 MIN.	S.S. VERTICAL DRILL PRESS W/MULTI-HEAD	1	38	1.25	33,000	30,000	500	2,500	5,000					
TOTALS						33,000				8,000					
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR. H. GOVE	PLY. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLY. ENGR. OHANESIAN	MATL. HDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLY. PLANNING VOLUME	REQ'D. PER VEHICLE 2	26 PC/HR.	16 HRS.	NEXT ASSY: SUPERSEDES:		OPER. NO.		

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR ECR NO. HELIOSTAT		PART NAME SLEEVE-MOTOR REV. COUNTER AZ. & EL				ISSUE DATES 9-8-80		PART NO. 531442-01						
FOR MODELS 50,000 ANN. VOL.		MATERIAL A151 1020 STEEL TUBING		WT./ LBS.	RGH.	FM.	RELEASE		SHEET	OF				
									2	4				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REVS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD		INST. TRYS/ST
40	DRILL RADIAL HOLES FOR 1/2 - 14 NPT, 1/4 - 28 UNF, & .123/.124 REAM HOLE & FIN. REAM	TURRET DRILL PRESS/WITH INDEX FIXTURE  ( REF. -BURGMASER)	26	26	1.88	132,000	120,000	2,000	10,000	20,000				
	EST. F. TO F. - 1.5 MIN.													
50	SPOTFACE .500 DIA INSIDE	SPECIAL RIGHT ANGLE ANGLE DRILL FIXTURE		128	.38	1,500	500		1,500	8,000				
TOTALS						133,500				28,000				
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. HDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REOMTS.	SUPERSEDES:					
								PC/NR.	NRS.					

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PLANT FORD AMROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT

PROGRAM OR ECR NO. BELLOSTAP		PART NAME SLEEVE-MOTOR REV COUNTER, AZ & EL				ISSUE DATES 9-8-80		PART NO. 531442-01					
FOR MODELS 30,000 ANN. VOL.		MATERIAL A151 1020 STEEL TUBING		WT./ LBS.		RGH.		FIN.		RELEASE	SHEET 3 OF 4		
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL- LATION	TOTAL	DESIGN	BUILD	
55	HOT DIP GALVANIZE PER ASTMA-153-73				GAL. SYST								
60	TAP //10-32 HOLES  EST. P. TO P. - 1.5 MIN.	VERT. TAPPING MACH.	1	26	1.88	33,000	30,000	500	2,500	6,000			
65	WASH	AVATL-			INC. IN MACH. CYC								
70	INSPECT & CONTAINERIZE	GAGES			IND. LAB					5,000			
	PERSONAL RELIEF				.48								
<b>TOTALS</b>						7.62	33,000			11,000			
REMARKS													
Mfg. Development Engrg. & Research		PROCESS ENGR. H. GOVE	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE 2	NEXT ASSY:	OPER. NO.			
		INDUSIV. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESTAN	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. 26 PC/HR. 16 HRS.	SUPERSEDES:				

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PROCESS ESTIMATE SHEET

PROGRAM OR SCH. NO. HELIOSTAT		PART NAME SLEEVE-MOTOR REV. COUNTER-AZ & EL			ISSUE DATES		DEPARTMENT PART NO. 531442-01 (73)							
ICR MODELS		MATERIAL PLANT ENGINEERING REQUIREMENTS			WT. LBS.	RGH.	FIN.	RELEASE		SKETCH 4 OF 4				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD		INST.
1	CHIP - COOLANT AND CLARIFICATION SYSTEMS					62,000	40,000	2,000	20,000					
2	COOLANT REFRIGERATION SYSTEM													
3	EXHAUST - FUME - DUST AND VENTILATION													
4	CO <sub>2</sub> FIRE PROTECTION SYSTEM													
5	MONORAIL CONVEYORS					40,000	20,000		20,000					
6	MONORAIL CARRIERS (TOOLING)									5,000				
7	ROLLER CONVEYOR					3,200	2,000	200	1,000					
8	POWERED CONVEYORS													
9	PLATFORMS - STILES													
10	SERVICE RAILS AND HOISTS													
11	TOOL CABINETS - RACKS AND STANDS					1,500	1,000		500					
12	TOOL CONTROL BOARDS													
13	WORK - GAGING AND INSPECTION TABLES					3,000	1,500		1,500					
14	PARTS BASKETS (EXPENSE)													1,500
15	PRODUCTION AIDS - ASSEMBLY AIDS					1,500	1,000		500					
16	SECONDARY LIGHTING													
17	PROGRAMMABLE CONTROLLERS													
18	AUTOMATIC - PART HANDLING SYSTEM													
19	ENGINEERING SERVICES DESIGN - (EXPENSE)													5,000
20	BUILDING SERVICES - UTILITIES													
21	POWER AND FREE CONVEYOR SYSTEM													
22	POWER AND FREE CONVEYOR CARRIERS (TOOLING)													
23	MACHINE FOUNDATIONS AND DECKS													
24	PLANT REARRANGEMENT (EXPENSE)													
25	MATERIALS HANDLING - RACKS - CONTAINERS - DURNAGE					2,500	2,000		500					
BUILDING CONSTRUCTION		1500												
TOTALS						113,700				5,000				6,500

REMARKS: TOTAL: FAC - 313,200  
 TOOL - 52,000 371,700  
 EXP. - 6,500

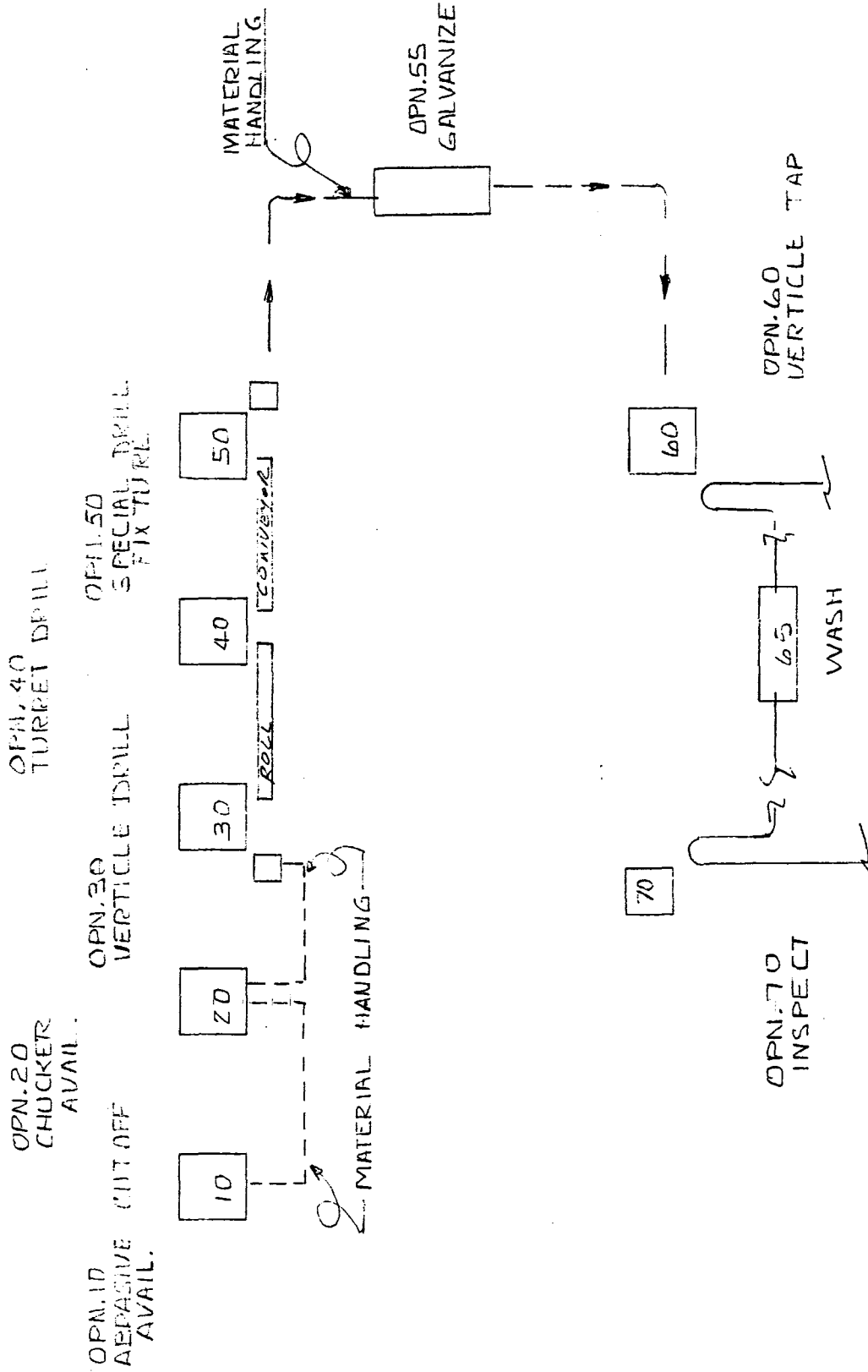
PLT. LAYOUT	AUTOMATION	DESIGN	MATE. BLDG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	HEAT ASSV.
PLT. ENGR.	PROGN.	DAILY PLT. PLANNING	INSPECTION			

OHANESIAN



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AREA- 1500 S.Q.FT.

SLEEVE-MOTOR REV. COUNTER  
 531442-01

PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT: (74)

PROGRAM OR ECR NO. HELIOSTAT		PART NAME ADAPTOR MOTOR REV. COUNTER. EL				ISSUE DATES 9-8-80		PART NO. 531442-04							
FOR MODELS 50,000 ANN. VOL.		MATERIAL A151 - 1020 STEEL			WT./LBS. 1.32		RGH. FIN.		RELEASE		SHEET 1 OF 2				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
	MATERIAL: A151 1020 SHEET STEEL 31" x 31" x .312 THICKNESS SHEARED IN STRIPS 3.875 x 31 EACH STRIP = 8 PARTS														
10	SHEAR SHEET STEEL IN EIGHT (8) EQUAL STRIPS 3.875 x 31" - TRANS. TO NEXT OPERATION	100 TON SHEAR PRESS	1	600	.08		EXISTING	# 531442-02							
20	FIRST STAGE PIERCE 1.62" DIA HOLE - SECOND STAGE - PIERCE 3.87 DIA DISC - TRANSFER TO NEXT OPERATION	500 TON SINGLE ACTION PRESS	1	600	.08		EXISTING	#531147	2,880	240	2,400	240			
30	PLACE IN CHUCK & FACE 1.62" DIA HOLE TO 2.69" DIA - .06 DEEP - TURN PART 180° & RE-CHUCK TURN O/D to 3.19" DIA .06 DEEP - TRANSFER TO NEXT OPERATION	FACE LATHE	1	60	.80		EXISTING	# 531442-13							
TOTALS									2,880						
REMARKS															
Mfg. Development Engr. & Research		PROCESS ENGR. HARDWAY	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME 208	1	FINAL						
								13 PC/HR. 16 HRS.	SUPERSEDES:						

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PROCESS ESTIMATE SHEET

PLANT FORD AEROSPACE

DEPARTMENT:

PROGRAM OR ECR NO. HELIOSTAT		PART NAME ADAPTOR MOTOR REV. COUNTER, EL.				ISSUE DATES 9-8-80		PART NO. 531442-04						
FOR MODELS 50,000 ANN. VOL.		MATERIAL A151 - 1020 STEEL		WT./ LBS.	RGH. 1.32	FIN.	RELEASE	SHEET	2	OF	2			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT			EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
		DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP.		TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRVQ/AT	
40	PLACE IN DRILL FIXTURE TWO (2) PASSES PER PASS- DRILL .201 HOLE FOUR (4) PLACES - DRILL .31" HOLE FOUR (4) PLACES - TRANSFER TO NEXT OPERATION	BENCH DRILL PRESS	1	120	.40		EXISTING	# 531442-06	1,920	160	1,600	160		
50	GALVANIZE TO SPEC. ASTM A153-73 TO 1.00 to 1.25 OZ/FT <sup>2</sup>													
60	TRANSFER TO FINAL ASSEMBLY													
	PERSONAL RELIEF				.09									
TOTALS					1.49				1,920					
REMARKS TOTAL: FAC - 0 ) 4,800 TOOL- 4,800) 4,800														
PROCESS ENGR.		PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:		OPER. NO.		
HARDWAY		LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLY. PLANNING VOLUME		1		FINAL				
INDUSTRY ENGR.						208		13 PC/HR. 16 HRS.		SUPERSEDES:				

Ford Mfg. Development  
Engrg. & Research

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT: \_\_\_\_\_

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PROGRAM OR EPA NO. HELIOSTAT		PART NAME COVER MOTOR REV. COUNTER				ISSUE DATES 9-8-80		PART NO. 531442-05							
FOR MODELS 50,000 ANN. VOL.		MATERIAL A151 - 1020 STEEL		WT./LBS. 1.90		RGM. .06		FIN.		RELEASE SHEET 1 OF 3					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'N REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRVCL		
	MATERIAL: BASE PLATE: A151 - 1020														
	SHEET STEEL 31" x 31" x .250 THICKNESS														
	CUT IN STRIPS 3.875" x 31"														
	EACH STRIP = 8 PARTS														
	WALL TUBING A151 - 1020														
	TUBING 2 1/4" DIA O/D x 1.8 WALL														
	TOP PLATE: A151 - 1020														
	SHEET STEEL 40" x 40" x 1/8 THICKNESS														
	CUT IN STRIPS 2 1/2" x 40"														
	EACH STRIP - 16 PARTS														
10	SHEAR STRIPS FOR BASE PLATE 3.875" x 31"	100 TON SHEAR PRESS	1	600	.08		EXISTING # 431442-02								
	TRANSFER TO NEXT OPERATION														
20	PIERCE 3.875" DISC WITH 1.750" HOLE IN CENTER - TRANS TO NEXT OPERATION	500 TON SINGLE ACTION PRESS	1	600	.08		EXISTING # 531447	1,800	150	1,500	150				
30	PLACE IN LATHE WITH FACE CHUCK AND TURN FACE RECESS .060 DEEP TO 3" DIA. - TRANSFER TO NEXT OPERATION	FACE LATHE	1	200	.24		EXISTING # 531453								
TOTALS															
REMARKS															
Mfg. Development Engg. & Research		PROCESS ENGR. HARDWAY	PLY. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE 2	NEXT ASSY: FIELD		OPER. NO.				
		INDUSTR. ENGR. S. LEWIS	LAD.	QUAL. CONTR.	PLT. ENGR. OHANESTAN	PRODN.	DAILY PLT. PLANNING VOLUME 416	REQMTS. 26 PC/HR. 16 HRS.	SUPERSEDES:						

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PROCESS ESTIMATE SHEET

PLANT		PROGRAM OR PEA NO.					PART NAME		ISSUE DATES		DEPARTMENT				
HELIOSTAT		50,000 ANN. VOL.					COVER MOTOR REV. COUNTER					PART NO. 531442-05		SHEET 2 OF 3	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRAVEL		
40	PLACE TWO (2) PARTS BACK TO BACK IN DRILL JIG & DRILL .201 HOLE FOUR (4) PLACES- TRANSFER TO WELD ASS'Y AREA	BENCH DRILL	1	120	.40		EXISTING	# 4314	42-06		120	1,200	120		
50	SAW TUBING 2 1/4" O/D IN .88" LENGTH - THREE PER PASS - TRANSFER TO WELD ASS'Y AREA	DO-ALL TYPE AUTOMATIC FEED BAND SAW	1	180	.27		EXISTING	# 5314	42-13						
60	SHEAR STRIPS FOR TOP COVER 2 1/2" x 40" - TRANSFER TO NEXT OPERATION	100 TON SHEAR PRESS	1	600	.08		EXISTING	# 5314	42-02						
70	PIERCE 2 1/2" DIA. DISC (16) PLACES PER STRIP - TRANSFER TO WELD ASS'Y AREA	500 TON SINGLE ACTION PRESS	1	600	.08		EXISTING	# 5314	47	1,080	90	900	90		
80	PLACE BASE PLATE, WALL TUBING & TOP PLATE IN MANUAL TURNING WELD FIXTURE & WELD TWO SEAMS PER AMER WELDING SOC. AWS, D1-1 CONTINUOUS WELD	FINE WIRE WELDER	1	60	.80		EXISTING	# 5314	42-15	1,440	120	1,200	120		
TOTALS										2,520					
REMARKS WELD BEAD = 1/8" x 1/8" x 14" = .06 lbs.															
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE		REQ'D. PER VEHICLE	NEXT ASSY:		FIELD		OPER. NO.	
		HARDWAY	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLY. PLANNING VOLUME	416	26 RC/HR.	2	16 NRS.				

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PLANT AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR ECR NO. HELTOSTAT		PART NAME COVER MOTOR REV. COUNTER				ISSUE DATES 9-8-80		PART NO. 531442-05						
FOR MODELS 50,000 ANN. VOL.		MATERIAL A151 - 1020 STEEL		WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 3 OF 3					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD		INST. TRAVEL
90	TRANSFER TO GALVANIZING AREA AND GALVANIZE PER ASTM A153-73 TO 1.00 TO 1.25 OZ/FT <sup>2</sup>				GAL. SYST.									
100	TRANSFER PART OF FIELD STORAGE SHIPPTNG AREA				IND. LAB									
	PERSONAL RELIEF				.14									
TOTALS					2.17									

REMARKS  
TOTAL: FAC - 0 )  
TOOL - 4,320 ) 4,320

PROG. ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.
HARDWAY						2	FIELD	
INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS.	SUPERSEDES:	
					416	26 PC/HR.	16 HRS.	

Mfg. Development  
Engr. & Research

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR PPN NO. HELIOSTAT		PART NAME ADJUSTER PC BOARD, AZ & EL				ISSUE DATES 9-11-80			PART NO. 531442-08						
FOR MODELS		MATERIAL STAINLESS STEEL - 302/304		WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 1 OF 2						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRAVEL		
05	RECEIVE PURCHASED 1/4 - 28 UNF - 2A x 1.75 IG SET SCREW - STAINLESS STEEL 302/304														
10	FIN. TURN, CHAMFER, FACE & GROOVE  EST. F. TO F. - .75 MIN.	BENCH LATHE (REF. HARDINGE) DV 59  GAGES		51	.94	9,200	8,000	200	1,000	1,000					
15	PASSIVATE PER ASTM A 380 OR QQ-P-35  PLACE IN CONTAINERS & SHIP  PERSONAL RELIEF														
TOTALS					1.00	9,200				1,200					
REMARKS REQ. SCREW PRICE															
PROCESS ENGR. H. GOVE		PLT. LAYOUT		AUTOMATION		DESIGN		MNTL. MDLG. ENGR.		DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:	
INDUSTR. ENGR. S. LEWIS		LAB.		QUAL. CONTR.		PLT. ENGR. OHANESTAN		PRODM.		DAILY PLT. PLANNING VOLUME		REQMTS. 26 PC/HRS. 16 HRS.		SUPERSEDES:	
Ford Mfg. Development Engrg. & Research															

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PROCESS ESTIMATE SHEET

PROGRAM OR ECU NO. HELIOSTAT		PART NAME ADJUSTER PC BOARD - AZ & EL				ISSUE DATES 9-12-80		DEPARTMENT: PART NO. 531442-08 (77)						
FOR MODELS		MATERIAL PLANT ENGINEERING REQUIREMENTS				WT./ LBS.	RGH.	FIN.	RELEASE	SHEET 2 OF 2				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHINE REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. COST	
1	CHIP - COOLANT AND CLARIFICATION SYSTEMS													
2	COOLANT REFRIGERATION SYSTEM													
3	EXHAUST - FUME - DUST AND VENTILATION													
4	CO2 FIRE PROTECTION SYSTEM													
5	MONORAIL CONVEYORS													
6	MONORAIL CARRIERS (COOLING)													
7	ROLLER CONVEYOR													
8	POWERED CONVEYORS													
9	PLATFORMS - STILES													
10	SERVICE RAILS AND HOISTS													
11	TOOL CABINETS - RACKS AND STANDS					500	250		250					
12	TOOL CONTROL BOARDS													
13	WORK - GAGING AND INSPECTION TABLES					1,000	500		500					
14	PARTS BASKETS (EXPENSE)													1,000
15	PRODUCTION AIDS - ASSEMBLY AIDS													
16	SECONDARY LIGHTING													
17	PROGRAMMABLE CONTROLLERS													
18	AUTOMATION - PART HANDLING SYSTEM													
19	ENGINEERING SERVICES DESIGN - (EXPENSE)													
20	BUILDING SERVICES - UTILITIES													
21	POWER AND FREE CONVEYOR SYSTEM													
22	POWER AND FREE CONVEYOR CARRIERS (COOLING)													
23	MACHINE FOUNDATIONS AND DECKS													
24	PLANT REARRANGEMENT (EXPENSE)													
25	MATERIALS HANDLING - RACKS - CONTAINERS - DUNNAGE													
BUILDING CONSTRUCTION		400 SQ. FT.												
TOTALS						1,500								1,000
REMARKS														
TOTALS: FAC - 10,700 TOOL - 1,200 12,900 EXP - 1,000														
PROCESS COST			PLT. LAYOUT		AUTOMATION		DESIGN		MATEL. HOLD. ENGR.		DAILY SERVICE		REQ'D. PER VEHICLE	
MATERIALS			PLT. ENGR.		MACH. ENGR.		PLT. ENGR.		MACH. ENGR.		DAILY PLT. PLANNING		REQUIREMENTS	



PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

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PROGRAM OR ORDER NO. HELIOSTAT	PART NAME MOUNT, ZERO REF. AZ	ISSUE DATES 9-11-80	PART NO. 531442-10
FOR MODELS 50,000 ANN. VOL.	MATERIAL A151- 1020 STEEL	WT./ LBS. 3.33	RELEASE SHEET 1 OF 2

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. BY QTY	
	MATERIAL: A151 - 1020 BAR STEEL													
	BASE PLATE = 3 1/2" x 25" x 1/4" THICKNESS													
	ONE PLATE = 5 PARTS													
	BOX SIDES = 1 3/4 x 21" x 1/4" THICKNESS													
	ONE PLATE = 7 PARTS													
	BOX ENDS = 1 3/4 x 10" x 1/4 THICKNESS													
	ONE PLATE = 10 PARTS													
10	SAW BASE ONE (1) PART PER PASS - BOX SIDES TWO PARTS PER PASS & BOX ENDS TWO PARTS PER PASS - TRANSFER TO NEXT OPERATION	DO-ALL TYPE AUTOMATIC BAND SAW	1	60	.80					EXISTING # 531442-13				
20	DRILL ONE HOLE .88" DIA END PLATE (ONE SIDE ONLY) - DRILL TWO (2) 7/16" HOLES BASE PLATE - DRILL TWO (2) .31" DIA HOLE SIDE PLATE (ONE SIDE ONLY) TRANSFER TO NEXT OPERATION	BENCH TYPE DRILL PRESS	1	25	1.92					EXISTING # 531442-14				
TOTALS														
REMARKS														

Mfg. Development Engr. & Research	PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. HDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.
	HARDWAY INDUSTR. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR. OILANESIAN	PRODN.	DAILY PLT. PLANNING VOLUME 208	1	SUPERSEDES:	
							13 PC/HR. 16 HRS.		

A-300

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR ECR NO. HELIOSTAT		PART NAME MOUNT, ZERO, REF. AZ				ISSUE DATES 9-11-80		PART NO. 531442-10							
FOR MODEL 50,000 ANN. VOL.		MATERIAL A151-1020 STEEL		WT./ LBS.	RGH. 3.33	FIN.	RELEASE	SHEET 2 OF 2							
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL- LATION	TOTAL	DESIGN	BUILD	MST. BYGONE		
30	MIL 1/8 x 45° CHAMFER ON OPEN END BASE PLATE - ELONGATE TWO (2) 7/16" HOLES TO 3/4" SAME END - CHAMFER BOX END PLATES 3/16" x 45° FOUR (4) PLACES - TRANSFER TO NEXT OPERATION	#3 MILLING MACHINE	1	80	.60		EXISTING # 531442-14								
40	WELD COMPLETE BOX TO BASE PLATE EIGHT (8) PLACES - TRANSFER TO NEXT OPERATION	FINE WIRE WELDER AUTOMATIC	1	20	2.40		EXISTING # 531447	960	80	800	80				
		GAGES						500							
50	GALVANIZE PER ASTM A153-73 TO 1.00 TO 1.25 OZ.-FT <sup>2</sup> - TRANSFER TO FINAL ASSEMBLY AREA				GAL. SYST.										
	PERSONAL BELIEF														
TOTALS					6.10			1,460							
REMARKS TOTAL: FAC - 0 TOOL- 1,460 } 1,460 EST - 0															
PROCESS ENGR. HARDWAY		PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO.					
INDUSTR. ENGR.		LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME 208	1	FINAL							
Mfg. Development Engr. & Research							REQMTL. 13 PC/HR.	SUPERSEDES:							
							16 HRS.								

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

80

DEPARTMENT:

PROGRAM OR CER NO. HELIOSTAT	PART NAME HOLDER, ZERO REF, AZ & EL	ISSUE DATES 9-9-80	PART NO. 5311442 - 11
FOR MODELS	MATERIAL A151 1020 STEEL	WT./RGM. FIN. LBS. 42	RELEASE SHEET 1 OF 3

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'Y REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRNG/2	
	MATERIAL: A151-1020 BAR STEEL 1 1/4" x 7/8" x 30" ONE BAR = 22 PARTS													
10	SAW INTO PARTS OF 1.25 x .870" x 1.34" THREE PARTS PER SAW PASS - TRANSFER TO NEXT OPERATION	DO-ALL TYPE AUTOMATIC FEED BAND SAW	1	180	0.27	41,000	37,000	1,000	3,000					
20	PLACE IN MILLING VICE TEN PARTS PER PASS AND MILL STEP AT 1.34" DIM TO 1.24" x .50 DEEP TRANSFER TO NEXT OPERATION	#3 VERTICAL MILLING MACHINE GAGES	1	120	0.40	23,600	21,000	630	2,000	400				
30	PLACE IN DRILL FIXTURE AND DRILL ONE (1) HOLE IN 1/8 WALL .141" DIA - ROTATE 90° AND DRILL TWO (2) HOLE FOR 1/4 - 20 UNC - 2B - TRANSFER TO NEXT OPERATION	BENCH DRILL PRESS GAGES	1	40	1.20	2,250	1,700	50	500	1,440	120	1,200	120	
TOTALS						66,850				1,840				

REMARKS

Ford	Mfg. Development Engrg. & Research	PROCESS ENGR. HARDWAY	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME 416	REQ'D. PER VEHICLE 2 26 PC/NR. 16 HRS.	NEXT ASSY: FINAL SUPERSEDES:	OPER. NO.
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME 416	REQ'D. PER VEHICLE 2 26 PC/NR. 16 HRS.	NEXT ASSY: FINAL SUPERSEDES:	OPER. NO.

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80

FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR CTR NO. HELIOSTAT		PART NAME HOLDER, ZERO REF, AZ & EL				ISSUE DATES 9-9-80		PART NO. 531442-11						
FOR MODEL 50,000 ANN. VOL.		MATERIAL A151-1020 STEEL		WT./ LBS.	RGH. .42	FIN.	RELEASE		SHEET 2 OF 3					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD		INST. FREIGHT
40	GALVANIZE PER SPEC. ASTM-A153 - 73 TO 1.00 to 1.25 OZ-FT <sup>2</sup> - TRANSFER TO NEXT OPERATION													
50	BENCH - MANUAL TAP TWO (2) HOLES TO 1/4 - 20 UNC - 2P TRANSFER TO FINAL ASSEMBLY AREA	HAND TOOLS	30	1.60						25		25		
	PERSONAL RELIEF			0.23										
TOTALS				3.70						25				
REMARKS														
Mfg. Development Engrg. & Research		PROCESS ENGR. HARDWAY	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR. OTIANESTAN	MATL. MOLDG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME 416	REQ'D. PER VEHICLE 2 26 PC/HR.	16 HRS.	NEXT ASSY: FINAL	SUPERSEDES:		OPER. NO.	

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PROLESS ESTIMATE SHEET

DEPARTMENT:

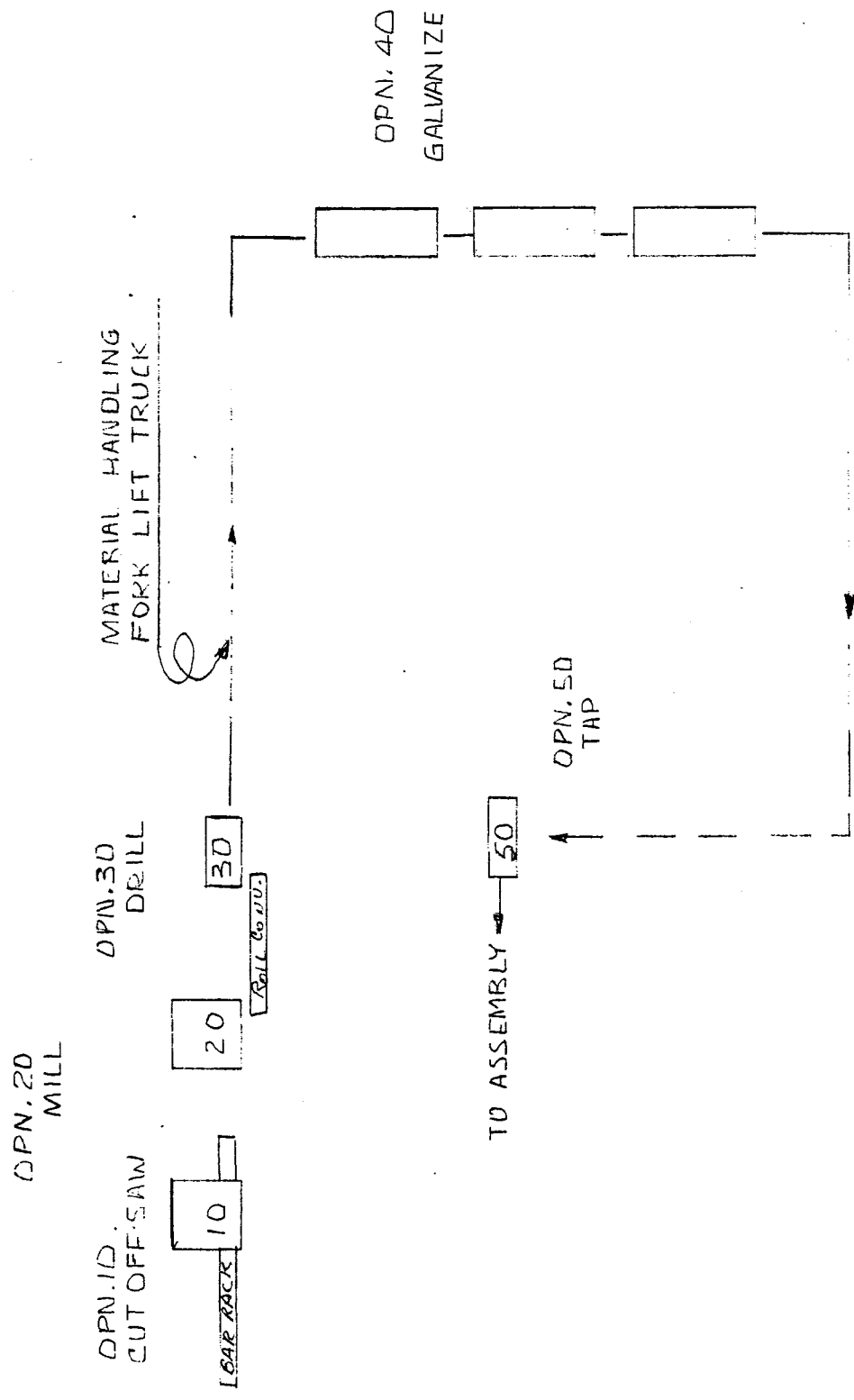
PROGRAM OR CCH NO.	PART NAME	ISSUE DATES	PART NO. 531442-11
FCR MODELS	MATERIAL PLANT ENGINEERING REQUIREMENTS	9-10-80	RELEASE
			SHEET 3 OF 3

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			
						TOTAL	BASIC	FREIGHT	INSTAL-LATION	TOTAL	DESIGN	BUILD	INST. COST
1.	CRIP - COOLANT AND CLARIFICATION SYSTEMS					15,500	10,000	500	5,000				
2.	COOLANT REFRIGERATION SYSTEM												
3.	EXHAUST - FUME - DUST AND VENTILATION												
4.	CO2 FIRE PROTECTION SYSTEM												
5.	MONORAIL CONVEYORS												
6.	MONORAIL CARRIERS (TOOLING)												
7.	ROLLER CONVEYOR					1,000	500		500				
8.	POWERED CONVEYORS												
9.	PLATFORMS - STILES												
10.	SERVICE RAILS AND HOISTS					6,200	3,000	200	3,000	2,000			
11.	TOOL CABINETS - RACKS AND STANDS					2,600	2,000	100	500				
12.	TOOL CONTROL BOARDS												
13.	WORK - GAGING AND INSPECTION TABLES					1,000	500		500				
14.	PARTS BASKETS (EXPENSE)												
15.	PRODUCTION AIDS - ASSEMBLY AIDS												
16.	SECONDARY LIGHTING												
17.	PROGRAMMABLE CONTROLLERS												
18.	AUTOMATION - PART HANDLING SYSTEM												
19.	ENGINEERING SERVICES DESIGN - (EXPENSE)												500
20.	BUILDING SERVICES - UTILITIES												
21.	POWER AND FREE CONVEYOR SYSTEM												
22.	POWER AND FREE CONVEYOR CARRIERS (TOOLING)												
23.	MACHINE FOUNDATIONS AND DECKS												
24.	PLANT REARRANGEMENT (EXPENSE)												
25.	MATERIALS HANDLING - RACKS - CONTAINERS - DUMPIAGE					5,000	5,000						
BUILDING CONSTRUCTION						800 SQ. FT.							
<b>TOTALS</b>						31,300				2,000			500

REMARKS TOTAL: FAC - 66,850  
 TOOL - 2,365 103,015  
 EXP - 33,800

PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATEL. HDLS. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	HEAT ASSY:
					DAILY PLT. PLANNING	IN COSTS	BIDDER/OWNER

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SQUARE FEET = 800

HOLDER - ZERO REF. - AZ & EL.  
 531442.11

PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT

82

PROGRAM OR ECR NO. HELLOSPAT	PART NAME MOUNT, ZERO REF, EL	ISSUE DATES 9-9-80	PART NO. 531142-13
FOR MODELS 50,000 ANN. VOL.	MATERIAL A151 1020 STEEL	WT./ LBS. 2.75	RELEASE SHEET 1 OF 3

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	MST. TRYOUT	
	MATERIAL: A151 1020 PLATE STEEL BASE = 3.00" x 5.00 x 3/8" THICKNESS BOX SIDES = (2) = 2 1/8" x 2 1/4" x 1/4" THICKNESS BOX ENDS = (1) = 1 1/4" x 2 1/4" x 1/4" THICKNESS BOX TOP = (1) = 1 3/4" x 2 3/8" x 1/4" THICKNESS													
10	BASE: PLATE STEEL IN 3.00" x 30" SAW THREE PIECES PER PASS - 5" LENGTH TRANSFER TO NEXT OPERATION	DO-ALL TYPE AUTOMATIC BAND SAW	1	90	.53	50,350	45,000	1,350	4,000					
20	PLACE TWELVE (12) PARTS IN TURNING FIXTURE & TURN 9 3/8" RAD WITH 1/8" x 45° CHAMFER- TRANSFER TO NEXT OPERATION	FACE LATHE	1	48	1.00	22,570	19,000	570	3,000	8,160	680	6,800	680	
30	DRILL TWO (2) HOLES 7/16" DIA ON 10" RAD PARALLEL TO 9 3/8" RAD - TRANSFER TO NEXT OPERATION	BENCH DRILL PRESS	1	60	.80	EXISTING # 277101	19-13			1,440	120	200	120	
40	PLACE IN MILL VICE AND ELONGATE 7/16" HOLES TO 3.4" TRANSFER TO WELD AREA	BRIDGE-PORT TYPE MILLING MACHINE	2	60	.80	14,360	12,000	360	2,000					
TOTALS						87,280				9,600				

REMARKS

Mfg. Development Engrg. & Research	PROCESS ENGR. HARDWAY	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR. OHANESTAN	MATL. MDLG. ENGR. PRDDN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME 208	REQ'D. PER VEHICLE 1 REQMTS. 13 PC/HR.	NEXT ASSY: FINAL SUPERSEDES: 16 HRS.	OPER. NO.
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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

82

PROGRAM OR CTR NO.		PART NAME		ISSUE DATES		DEPARTMENT									
HELIOSTAT		MOUNT ZERO REF, EL		9-9-80		PART NO. 531442-13									
FOR MODELS		MATERIAL		WT./ LBS.		RELEASE									
50,000 ANN. VOL.		A151-1020 STEEL		2.75		SHEET 2 OF 3									
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTAL-LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT		
50	BOX SIDE (2) = 2 1/8" x 2 1/4" x 1/4" THICKNESS - PLATE STEEL = 2 1/8" x 4 1/2" - SAW THREE PIECES PER PASS = 20 PARTS PER PLATE TRANSFER TO NEXT OPERATION	DO-ALL TYPE AUTOMATIC BAND SAW	1	120	.40	EXISTING	# 277101	20-5							
60	DRILL TWO (2) HOLES 5/16" DIA - LEFT SIDE ONLY - TRANSFER TO NEXT OPERATION	BENCH DRILL PRESS	1	120	.40	EXISTING	# 277101	9-14	1,440	120	1,200	120			
70	PLACE IN MILL VICE AND ELONGATE 5/16" HOLE TO 5/8" LONG LEFT SIDE ONLY - FACE CLEAN UP 2.375 END RT & LT & CHAMFER LOWER SIDE 3/16" x 45° - TRANS. TO WELD ASS'Y AREA	BRIDGE - PORT TYPE MILLING MACHINE	1	30	1.60	EXISTING	# 531442	13							
80	BOX TOP (1) 1 1/4" x 2 1/4" x 1/4" THICKNESS - SAW FROM PLATE STOCK 1 1/4" x 30" THREE PIECES PER PASS = 16 PARTS PER BAR TRANSFER TO NEXT OPERATION	DO-ALL TYPE AUTOMATIC BAND SAW	1	120	.40	EXISTING	# 277101	20-5							
TOTALS															
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR. HARDWAY	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	1	NEXT ASSY:	FINAL	OPER. NO.			
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESTIAN	PRODN.	DAILY PLT. PLANNING VOLUME	208	REQMTS.	13 PC/HR.	16 HRS.	SUPERSEDES:			

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(82)

PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR CTR NO. HELITOSTAT		PART NAME MOUNT ZERO REF, EL			ISSUE DATES 9-9-80		PART NO. 531442-13								
FOR MODELS 50,000 ANN. VOL.		MATERIAL A151-1020 STEEL		WT./ LBS. 2.75		RGH. FIN.		RELEASE		SHEET 3 OF 3					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	MAINT. TRAVEL		
90	PLACE IN DRILL FIXTURE AND DRILL ONE (1) .875 DIA HOLE - TRANSFER TO NEXT OPERATION	BENCH DRILL PRESS	1	120	.40	EXISTING	# 531442-06			720	60	600	60		
100	PLACE IN MILL VICE & CLEAN UP EXPOSED FACE - RE-CLAMP AND MILL RT-IT WELD EDGE 3/16" x 45° - TRANSFER TO WELD ASSEMBLY AREA	BRIDGE-PORT TYPE MILLING MACHINE	1	30	1.60	EXISTING	# 531442-13								
110	PLACE BASE PLATE IN WELD FIXTURE - LOCATE & CLAMP SIDES - LOCATE END & TOP CLAMP - WELD COMPLETE TRANSFER TO NEXT OPERATION	AUTOMATIC FINE WIRE WELDER	1	20	2.40	EXISTING	# 531442-15								
120	GALVANIZE PER ASTM A153-73 TO 1.00 TO 1.25 OZ.-FT <sup>2</sup> - TRANSFER TO FINAL ASSEMBLY AREA					GAL. SYSTEM									
	PERSONAL RELIEF				.69										
TOTALS					11.02					2.160					
REMARKS WELD BEAD = 3/16" x 3/16" x 13" = .128 lbs. TOTAL: FAC - 87,280) 100,480 TOOL- 13,200)															
PROCESS ENGR. HARDWAY		PLT. LAYOUT		AUTOMATION		DESIGN		MATH. MDLG. ENGR.		DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:	
INDUSTR. ENGR.		LAB.		QUAL. CONTR.		PLT. ENGR.		PRODN.		DAILY PLT. PLANNING VOLUME		REQMTS.		SUPERSEDES:	
Mfg. Development Engrg. & Research										208		1		FINAL	
										13 PC/NR.		16 HRS.			

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT

83

PROGRAM OR CTR NO. HELIOSTAT		PART NAME BRACKET MAGNET HOLDER, ZERO REF, EL				ISSUE DATES 9-11-80		PART NO. 531442-14								
FOR MODELS 50,000 ANN. VOL.		MATERIAL A151-1020 STEEL		WT./ LBS. 1.97		RGH. FIN.		RELEASE		SHEET 1 OF 2						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST		
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT			
	MATERIAL: A151-1020 BAR STEEL 3 1/2" x 32" x 1/2" THICKNESS ONE BAR = 8 PARTS															
10	SAW BAR STEEL INTO EIGHT EQUAL PARTS OF 4" LENGTH- 3 PARTS PER PASS TRANSFER TO NEXT OPERATION	DO-TYPE AUTOMATIC BAND SAW	1	120	.40	EXISTING	# 531442-13									
20	PLACE IN DRILL FIXTURE AND DRILL ONE (1) HOLE FOR 3/4-16-UNF-2B THREAD- DRILL SIX (6) HOLES .28" AND TRANSFER TO NEXT OPERATION	BENCH DRILL PRESS	1	80	.60	3,075	2,500	75	500	2,880	240	2,400	240			
30	PLACE IN TURNING FIXTURE 12 PARTS PER PASS & TURN ON 8 1/4" RAD W/1/16 x 45° CHAMFER - TRANSFER TO NEXT OPERATION	FACE LATHE	1	120	.40	EXISTING	# 531442-13			3,840	320	3,200	320			
<b>TOTALS</b>						3,075				6,720						
<b>REMARKS</b>																
Mfg. Development Engrg. & Research		PROCESS ENGR. HARDWAY INQUIRY ENGR. S. LEWIS	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR. OHANESIAN	MATL. MDLG. ENGR. PRODN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME 208	REQ'D. PER VEHICLE 1 REQMTS. 13 PC/HR. 16 HRS.	NEXT ASSY: FINAL SUPERSEDES:		OPER. NO.					

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT:

PROGRAM OR ECM NO. HELIOSTAT		PART NAME BRACKET, MAGNET HOLDER ZERO REF, EL				ISSUE DATES 9-11-80		PART NO. 531442-14									
FOR MODELS 50,000 ANN. VOL.		MATERIAL A151-1020 STEEL		WT./ LBS. 1.97		RGH. FIN.		RELEASE		SHEET 2 OF 2							
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST			
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. (BY CAT)				
40	MILL 45° ENDING WITH 1 1/16" RAD - INDEX AND ELONGATE THREE (3) SLOTS AT .28" HOLES - TRANSFER TO NEXT OPERATION	#3 MILLING MACHINE	1	30	1.60	EXISTING	# 531442-06										
50	HOT DTP GALVANIZE PER ASTM A153-73 to 1.00 TO 1.25 OZ - FT <sup>2</sup> - TRANSFER TO NEXT OPERATION				GAL. SYST.												
60	BENCH TAP MANUALLY ONE (1) 3/4" IMF - 2B THREAD - TRANSFER TO FINAL ASSEMBLY AREA	HAND TOOLS		60	80					25		25					
	PERSONAL RELIEF				25												
TOTALS					4.05					25							
REMARKS												TOTAL: FAC - 3,075 TOOL - 6,745 EXP - 0 } 9,820					
PROCESS ENGR.		PLT. LAYOUT		AUTOMATION		DESIGN		NATL. MDLG. ENGR.		DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:		OPER. NO.	
HARDWAY		LAB.		QUAL. CONTR.		PLT. ENGR.		PRODN.		DAILY PLT. PLANNING VOLUME		REQMTS.		SUPERSEDES:			
Mfg. Development										208		13 PC/HRS. 16 HRS.					
Engrg. & Research																	

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

DEPARTMENT: (84)

PROGRAM OR CER NO. HELIOSTAT		PART NAME BRACKET MAGNET HOLDER ZERO REF, AZ				ISSUE DATES 9-9-80		PART NO. 531442-15							
FOR MODELS 50,000 ANN. VOL.		MATERIAL A151-1020 STEEL		WT./ LBS. 1.0	RGH.	FIN.	RELEASE	SHEET 1 OF 2							
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'Y REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. BRYCAT		
	MATERIAL: A151-1020 SHEET STEEL PURCHASE STEEL STRIPS														
	TOP PLATE 2 1/2" x 32.5" x 1/4" THICKNESS = 10 PARTS														
	END PLATE 1 3/4" x 35" x 1/4" THICKNESS = 10 PARTS														
10	TOP PLATE FIRST STAGE TRIM WELD SIDE AT 6° TWO (2) PLACES & PIERCE TAP HOLE FOR 3/4" 16 UNC 2-B - SECOND STAGE CUT OFF TO 3.250 LENGTH TRANSFER TO WELD ASSEMBLY OPERATION	200 OBS PRESS	1	600	.08	200,400	180,000	5,400	15,000	3,000	250	2,500	250		
20	END PLATE FIRST STAGE NOTCH 1/2" x 45° TWO (2) PLACES-PIERCE TWO (2) HOLES 7/16" DIA - SECOND STAGE CUT OFF & RESTRIKE 6° C/L OFF - TRANSFER TO WELD ASSEMBLY OPERATION	200 OBS PRESS	1	600	.08	SAME AS ABOVE				3,840	320	3,200	320		
<b>TOTALS</b>						200,400				6,840					
<b>REMARKS</b>															
Mfg. Development Engr. & Research		PROCESS ENGR. HARDWAY	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
		INDUSTR. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESIAN	PRODR.	DAILY PLT. PLANNING VOLUME 208	1	WELD						
								13 PC/HR. 16 HRS.	SUPERSEDES:						

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PLANT FORD AEROSPACE

PROCESS ESTIMATE SHEET

84

DEPARTMENT:

PROGRAM OR CRH NO. HELIOSTAT	PART NAME BRACKET MAGNET HOLDER ZERO REF, AZ	ISSUE DATES 9-9-80	PART NO. 531442-15
FOR MODELS 50,000 ANN. VOL.	MATERIAL A151-1020 STEEL	WT./ LBS. 1.0	RELEASE SHEET 2 OF 2

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	WST. TRYOUT	
30	PLACE TOP PLATE IN WELD FIXTURE - BARBER END PLATE TO RECEIVE WELD	AUTOMATIC FINE WIRE WELDER	2	60	.80	8,210	7,000	210	1,000	720	60	600	60	
35	AND PLACE FIXTURE - WELD TWO (2) LOCATION WITH AMERICAN WELDING SOCIETY AWS D1-1- TRANSFER TO NEXT OPERATION	BENCH GRINDER	1	60	.80	150	50	2	100					
40	GALVANTZE PER ASTM A153-73 TO 1.00 TO 1.25 OZ-Ft <sup>2</sup> - TRANSFER TO NEXT OPERATION													
50	BENCH - HAND REAM & TAP 3/4" 16 UNC - 2B HOLE - TRANSFER TO FINAL ASSEMBLY AREA	HAND TOOLS	1	60	.80	125	25	1	100					
		GAGES								2,000				
	PERSONAL RELIEF				.17									
<b>TOTALS</b>						2.73	8,485			2,720				

REMARKS WELD BEAD = .187" x .187 x 14" = .138 lbs. TOTAL: FAC - 208,885) 218,445  
TOOL - 9,560)  
EXP - 0

PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	NATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.
HARDWAY						1	FINAL	
INDUSTRY ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQ'TS.	SUPERSEDES:	
					208	13 PC/NR. 16 NRS.		

Mfg. Development  
Engrg. & Research

A-312

PROCESS ESTIMATE SHEETSON-SITE HELIOSTAT ASSEMBLY

Sheet 1	Load Gimbal Assembly into fixture	A-314
2	Assemble Elevation Drive to Gimbal	
3	Assemble Torque Tube to Gimbal	
4	Assemble Elevation Drive to Torque Tube	
5	Sub-assemble Angles to Reflector Support Beams	
6	Sub-assemble Bars to Reflector Support Beams	
7	Assemble Reflector Support Beams to Torque Tube	
8-9	Assemble Struts to Reflector Support Beams	
10	Sub-assemble Panel Attachment Brackets to Reflector	
11	Assemble Reflector Panels to Reflector Support Beams	
12	Lockwire Reflector to Angle/Bar	
13	Remove Heliostat Assembly from fixture	
14-16	Direct Labor Standards Recap	
17	Install Heliostat Assembly to Pedestal	
Sketches	Major Shipping Assemblies	A-331
	Field Assembly Building	
	Transporting Trailer	
	Proposed Assembly Sequence	
	Assembling Heliostat to Pedestal	

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PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO.		PART NAME			ISSUE DATES		DEPARTMENT								
FOR MODELS FINAL FIELD ASSEMBLY		LOAD GIMBAL ASSEMBLY INTO FIXTURE			9/8/80		PART NO.								
		MATERIAL			WT./	RGH.	FIN:	RELEASE		SHEET 1 OF 1					
					LBS.										
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. YR/CR.		
	PARTS REQ'D (1) GIMBAL ASSEMBLY														
10	RECEIVE GIMBAL ASSEMBLIES AND TRANSPORT TO LINE OPERATIONS	2-TON FORK LIFT TRUCK			IND LAB										
20	PICK UP GIMBAL ASSEMBLY AND LOAD INTO FINAL ASSEMBLY FIXTURE CLOSE (4) CLAMPS	SPECIAL HANDLING DEVICE OVERHEAD BRIDGE SYSTEM 1-TON HOIST FINAL ASSEMBLY FIXTURE	2		1.00					5,000					
						10,000				250,000					
TOTALS					1.00	10,000				255,000					
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
		INDUSYR. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLY. ENGR.	PRODN.	DAILY PLY. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES.						

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PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO.		PART NAME				ISSUE DATES		DEPARTMENT							
FOR MODELS		MATERIAL				WT./ LBS.		RGH.		FIN.					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRVOLT		
	PARTS REQ'D: (1) ELEVATION DRIVE ASSY. (1) PIN = 1" O.D. (2) RETAINING RINGS														
10	RECEIVE ELEVATION DRIVE ASSEMBLIES AND TRANSPORT TO LINE OPERATION				IND LAB.										
20	PICK UP ELEVATION DRIVE ASSEMBLY AND LOAD INTO FINAL ASSEMBLY FIXTURE, CLOSE (1) CLAMP	SPECIAL HANDLG. DEVICE OVERHEAD BRIDGE SYSTEM 1/2-TON HOIST FINAL ASSY. FIXTURE	2		0.80					5,000					
30	ALIGN HOLE IN ELEVATION DRIVE WITH HOLE IN BRACKET ON GIMBAL, INSERT (1) PIN	ALIGNMENT TOOL MALLETT			.30										
40	ASSEMBLE (1) RETAINING RING TO EACH END OF PIN, RELEASE CLAMP	HAND TOOL			.30										
TOTALS					1.40					5,000					
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY.	OPER. NO.					
		INDUSTY. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/NR. HRS.	SUPERSEDES.	20					

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PROCESS ESTIMATE SHEET

PROGRAM OR CER NO.		PART NAME				ISSUE DATES			DEPARTMENT					
FOR MODELS		MATERIAL				WT./LBS.	RGH.	FIN.	PART NO.		RELEASE		SHEET 1 OF 1	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.Y. NUMBER	MACH'S RECD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRVOLT	
	PARTS REQ'D:													
	(1) TORQUE TUBE ASSY.													
	(4) THRUST WASHERS - DETAIL (#41)													
	(2) PINS - 1" O.D. -DETAIL #18													
	(4) RETAINING RINGS-DETAIL #32													
10	RECEIVE TORQUE TUBES AND TRANSPORT TO LINE OPERATION				END LAB									
20	PICK UP TORQUE TUBE ASSY AND LOAD INTO FIXTURE, POSITIONING THE ELEVATION DRIVE SHAFT THROUGH THE TORQUE TUBE ACTUATOR ARM, CLOSE (2) CLAMPS	SPECIAL HANDLING DEVICE 2			1.40					5,000				
		OVERHEAD BRIDGE SYSTEM												
		1/2 - TON HOIST												
		FINAL ASSY. FIXTURE							(FROM OPER. 10)					
30	ALIGN HOLES IN RING ADAPTOR FORKS ON TORQUE TUBE WITH HOLES IN BRACKET ON GIMBAL, INSERT (2) THRUST WASHERS AND (1) PIN IN EACH OF (2) PIVOT BRK'TS.	ALIGNMENT TOOL			.80									
		MALLET												
40	ASSEMBLE (1) RETAINING RING TO EACH END OF THE (2) PINS	HAND TOOL			.40									
TOTALS					2.60					5,000				
REMARKS														
Mfg. Development Engng. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTY. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. MRS.	SUPERSEDES:	30				

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PROCESS ESTIMATE SHEET

PROGRAM OR CTR NO.		PART NAME				ISSUE DATES			DEPARTMENT					
FOR MODELS		MATERIAL				WT./	RGH.	FIN.	PART NO.		SHEET		OF	
FINAL FIELD ASSEMBLY						LBS.			9/8/80		1		1	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR D.T. NUMBER	MACH'S. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
	PARTS REQ'd:													
	(2) TRUNNION ADAPTORS - DETAIL #3													
	(8) FLAT WASHERS - 3/8"-DETAIL #37													
	(8) LOCK WASHERS - 3/8"-DETAIL #38													
	(8) BOLTS - 3/8-16 - DETAIL #39													
	(8) NUTS - 3/8-16 - DETAIL #40													
10	ADJUST ELEVATION ACTUATOR NUT TO ALIGN WITH HOLES IN TORQUE TUBE ACTUATOR ARM	MANUAL FINAL ASSY. FIXTURE			.50					(FROM OPER. 10)				
20	POSITION ELEVATION DRIVE TRUNNION ADAPTOR TO EACH END OF ACTUATOR TUBE ACTUATOR ARM, LOOSE ASSEMBLE (4) BOLTS, FLAT WASHERS, LOCK WASHERS & NUTS THRU EACH TRUNNION ADAPTOR & ACTUATOR ARM.	MANUAL			1.60									
30	SECURE (8) NUTS WITH POWER TOOL	BOX END WRENCH PNEUMATIC RIGHT ANGLE NUT RUNNER			.60	4,000				1,000				
TOTALS					2.70	4,000				1,000				
REMARKS														
Mfg. Development Engr. & Research		INDUST. ENGR. S. LEWIS	PLT. LAYOUT LAB.	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO.			
			QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR.	HRS.	SUPERSEDES.		40			

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PROCESS ESTIMATE SHEET

PROGRAM OR P.E. NO.		PART NAME				ISSUE DATES		PART NO.								
FINAL FIELD ASSEMBLY		SUB-ASSEMBLY ANGLE TO SUPPORT BEAMS				9/8/80		REF. 277- 10120								
OPER. NO.		TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER		MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST		
							TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. PAYOFF		
PART REQ'D:																
(4) SUPPORT BEAMS - DETAIL #8, 10																
(24) ANGLE BRKTS-DETAIL #4, 24																
(56) BOLTS, WASHERS, NUTS DETAIL #14		16, 18, 21, 22, 23														
10	RECEIVE SUPPORT BEAMS AND TRANSPORT TO LINE					IND LAB										
20	PICK UP SUPPORT BEAM AND LOAD INTO SUB-ASSY. FIXTURE, CLOSE (2) CLAMPS	SPECIAL HNDLG. HOOK		2		1.00					5,000					
		OVERHEAD BRIDGE SYSTEM														
		1/4-TON HOIST														
		SUB-ASSY. FIXTURE		4			2,000				10,000					
30	POSITION (4) ANGLE BRKTS TO SUPPORT BEAM, LOOSE ASSEMBLE (2) BOLTS, NUTS, & WASHERS EACH ANGLE - SECURE WITH POWER TOOL.	RT. ANGLE PNEUMATIC NUTRUNNER				1.55	4,000									
		BOX END WRENCH														
40	POSITION (2) ANGLE BRKTS TO SUPPORT BEAM, LOOSE ASSEMBLE (3) BOLTS, NUTS, & WASHERS EACH ANGLE - SECURE WITH POWER TOOL	RT. ANGLE PNEUMATIC NUTRUNNER				1.10	4,000									
		BOX END WRENCH														
50	REPEAT EL. 20, 30, 40 FOR (3) MORE SUPPORT BEAMS					10.95										
TOTALS		SUBTOTAL OPER 50				14.60	10,000				15,000					
REMARKS																
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	RENT ASSY:	OPER. NO.						
S. LEWIS		INDUST. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRDGN.	DAILY PLT. PLANNING VOLUME	RECHYS.	SUPERSEDES.	50						
							PC/HR.	HRS.								

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PROCESS ESTIMATE SHEET

PLANT		PROGRAM OR ECR NO.					PART NAME SUB-ASSEMBLY BAR TO SUPPORT BEAM			ISSUE DATES 9/9/80		DEPARTMENT			
FOR MODELS FINAL FIELD ASSEMBLY		MATERIAL			WT./ LBS.	RGH.	FIN.	PART NO. REF. 277-1C120		RELEASE		SHEET 1 OF 1			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRVCT		
	PARTS REQUIRED: (4) BAR-DETAIL #20 (12) BOLTS & NUTS, (24) WASHERS	- DETAIL #13, 16, 18													
10	POSITION BAR TO CENTER OF SUPPORT BEAM, LOOSE ASSEMBLE (3) BOLTS, (6) WASHERS & (3) NUTS - SECURE WITH POWER TOOL	RT. ANGLE PNEUMATIC BOX END WRENCH			.55	4,000									
20	UNCLAMP SUPPORT BEAM AND TRANSFER TO LINE OPERATION				.30										
30	REPEAT ELEMENTS 10 & 20 FOR (3) MORE SUPPORT BEAM.				2.55										
TOTALS					3.40	4,000									
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO. 60					
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/NR. HRS.	SUPERSEDES:						

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(45)

PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO.		PART NAME				ISSUE DATES		DEPARTMENT							
FOR MODELS		ASSEMBLE SUPPORT BEAMS TO TORQUE TUBE				9/9/80		PART NO.							
FINAL FIELD ASSEMBLY		MATERIAL				WT./ RGN. FIN.		RELEASE		SHEET / OF /					
						LBS.									
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRNG./T		
	PARTS REQ'D: (4) SUPPORT BEAM FROM PREV. OPERATION #60 (96) BOLTS, NUTS- DETAIL #12, 16 (192) WASHERS - DETAIL #18														
10	PICK UP SUPPORT BEAM AND POSITION TO TORQUE TUBE IN FINAL ASSEM. FIXTURE, CLOSE (2) CLAMPS	SPECIAL HNDLG. HOOK  OVERHEAD BRIDGE SYSTEM  1/4 - TON HOIST	2		1.50					5,000					
20	ALIGN MATING HOLES AND LOOSE ASSEMBLE (24) BOLTS & NUTS AND 48 WASHERS, SECURE WITH POWER TOOL	FINAL ASSY. FIXTURE ALIGNMENT TOOL  RT. ANGLE PNEUMATIC NUTRUNNER			3.35				(FROM OPER. #10)	8,000					
30	RELEASE (2) CLAMPS				.20										
40	REPEAT ELEMENTS 10, 20, 30 FOR (3) MORE SUPPORT BEAMS				15.15										
TOTALS		SUB-TOTAL			20.20	8,000				5,000					
REMARKS															
Mfg. Development Engrg. & Research		INDUSTY. ENGR. S. LEWIS	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN PLT. ENGR.	MATL. MDLG. ENGR. PRDGN.	DAILY SERVICE DAILY PLT. PLANNING VOLUME	REQ'D. PER VEHICLE REQMTS. PC/HR.	NEXT ASSY: SUPERSEDES:	OPER. NO. 70					

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PROCESS ESTIMATE SHEET

PROGRAM OR EEM NO.		PART NAME				ISSUE DATES		DEPARTMENT						
FOR MODELS		MATERIAL				WT./LBS.	RGH.	FIN.	PART NO.		SHEET			
FINAL FIELD ASSEMBLY									REF. 277-10120		1 OF 2			
						9/9/80		RELEASE						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTAL-LATION	TOTAL	DESIGN	BUILD	MST. TRVCS	
	PARTS REQUIRED:													
	(8) STRUT - DETAIL #5													
	(20) BOLTS, NUTS, WASHERS - DETAIL #14, 16, 18													
10	POSITION STRUT BETWEEN TWO SUPPORT BEAMS AT ANGLE BRKTS. LOOSE ASSEMBLE WITH (1) NUT, BOLT & WASHER AT EACH END OF STRUT	MANUAL. FINAL ASSY. FIXTURE								(FROM OPER #10)				
20	POSITION 2nd/STRUT BETWEEN TWO SUPPORT BEAMS AT ANGLE BRKTS., LOOSE ASSEMBLE WITH (1) NUT, BOLT & WASHER AT EACH END OF STRUT.	MANUAL			30									
30	LOOSE ASSEMBLE (1) BOLT, NUT & WASHER CONNECTING TWO STRUTS AT CENTER.	MANUAL			10									
40	SECURE ALL NUTS WITH POWER TOOL.	RT. ANGLE PNEUMATIC NUTRUNNER BOX END WRENCH			.35	4,000								
TOTALS						4,000								
REMARKS														
Mfg. Development Engg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				80
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:					

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PROCESS ESTIMATE SHEET

PLANT _____		PROGRAM OR C/P NO.						PART NAME ASSEMBLE STRUTS TO SUPPORT BEAMS				ISSUE DATES 9/9/80		DEPARTMENT					
FOR MODELS FINAL FIELD ASSEMBLY		MATERIAL						WT./ LBS.		RGH.		FIN.		PART NO. REF. 277-10120		RELEASE		SHEET 2 OF 2	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST					
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. BYOJAT						
50	REPEAT OPERATIONS 10, 20, 30, 40, FOR (3) MORE SETS OF STRUTS.				4.35														
TOTALS SHR-TOTAL OPER. #80						5.80													
REMARKS																			
<i>Ford</i> Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO. 80								
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES.										

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**PROCESS ESTIMATE SHEET**

PLANT \_\_\_\_\_ PROGRAM OR CTR NO \_\_\_\_\_ PART NAME SUB-ASSEMBLE ATTACHMENT BRK'TS. TO REFLECTOR ISSUE DATES 9/9/80 DEPARTMENT \_\_\_\_\_

FOR MODELS FINAL FIELD ASSEMBLY MATERIAL WT./RGH./FIN. LBS. PART NO. REF. 277-10116 SHEET 1 OF 1

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. BY COST		
	PARTS REQ'D:														
	(12) REFLECTOR ASSY'S, - DETAIL #4														
	(48) ATTACH. BRKTS - (3) TYPES - DETAIL # 7, 8, 11														
	(96) PADS - DETAIL #10														
	(AR) SHIM - (2) TYPES - DETAIL # 9, 13														
10	RECEIVE REFLECTOR ASSY'S & TRANSPORT TO LINE OPER. AREA.				TND. LAB										
20	PICK UP REFLECTOR ASSY. & POSITION IN FIXTURE.	SPECIAL HNDLG. DEVICE	2		2.00					5,000					
		OVERHEAD BRIDGE SYSTEM													
		1/4 TON HOIST													
		SUB-ASSY. FIXTURE	12							80,000					
30	SELECT PROPER ATTACH. BRK'T., INSERT LOWER PAD, POSITION BRK'T TO REFLECTOR AT LOCATOR, GAGE FOR SHIM REQ'MTS - (4) BRK'T/REFLECTOR	SPECIAL GAGE			2.00					10,000					
40	APPLY ADHESIVE TO SHIMS & BOND TO UPPER PAD, INSERT BETWEEN REFLECTOR & BRKT - (4) BRK'TS/REFLECTOR.	HAND TOOL ADHESIVE BRUSH			1.60										
50	REPEAT ELEMENTS 20, 30 & 40 FOR ELEVEN (11) MORE REFLECTORS				61.60										
TOTALS SUB TOTAL - OPER 90					67.20					95,000					
REMARKS															
		PROCESS ENGR. L. PALMER	PLT. LAYOUT	AUTOMATION	DESIGN	NATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
		INDUSTY. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODM.	DAILY PLT. PLANNING VOLUME	REQ'TS. PC/HR. HRS.	SUPERSEDES.	90					

Mfg. Development Engrg. & Research

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PROCESS ESTIMATE SHEET

PLANT		PROGRAM OR EPR NO				PART NAME				ISSUE DATES				DEPARTMENT			
						ASSEMBLE REFLECTOR ASSY'S TO SUPPORT BEAMS				9/9/80				PART NO. REV. 277-10116			
FOR MODELS		MATERIAL				WT./ RGM. FIN.				RELEASE				SHEET 1 OF 1			
FINAL FIELD ASSEMBLY																	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.Y. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST			
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. UPGRADE				
	PARTS REQ'D:																
	(12) REFLECTOR ASS'YS. FROM SUB-ASSY. OPERATION #90																
	(96) BOLTS & NUTS - DETAIL #14, 17																
	(196) WASHERS - DETAIL #18																
10	PICK UP REFLECTOR ASSY. & POSITION TO FIXTURE	SPECIAL HANDLING DEVICE			2.50												
		OVERHEAD BRIDGE SYSTEM															
		1/2-TON HOIST															
		FINAL ASSY. FIXTURE								(FROM OPER #10)							
20	ALIGN HOLES IN REFLECTOR ATTACH. BRKT. WITH HOLES IN ANGLE OR BAR ON SUPPORT BEAMS, LOOSE ASSEMBLE (2) BOLTS, (4) WASHERS, (2) NUTS - REPEAT FOR (3) REMAINING BRKTS.	MANUAL			.80												
		ALIGNMENT TOOL															
30	SECURE ALL NUTS WITH POWER TOOL.	RT. ANGLE PNEUMATIC NUTRINNER			40	4,000					1,000						
40	REPEAT ELEMENTS 10, 20, 30 FOR (1) MORE REFLECTORS				40.70												
TOTALS					SUB TOTAL - OPER. 100	44.40	4,000				1,000						
REMARKS																	
Mfg. Development		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.							
Engrg. & Research		INDUST. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:	100							

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PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO.		PART NAME				ISSUE DATES		DEPARTMENT							
FOR MODELS FINAL FIELD ASSY.		LOCKWIRE REFLECTOR ASSY. TO ANGLE/BAR				9/9/80		PART NO. REF. 277-10116							
		MATERIAL		WT./LBS.	RGH.	FIN.	RELEASE		SHEET 1 OF 1						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRNG/QT		
	PARTS REQ'D.: (AR) WIRE														
10	CUT WIRE OFF ROLL TO LENGTH REQ'D AND LOOP THRU HOLES IN BRKT. ON REFLECTOR ASSY. - (48) LOCATIONS	WIRE CUT-OFF DEVICE FINAL ASSY. FIXTURE			5.00	2,000									
20	TWIST WIRE AS REQ'D. ROUTE THRU BAR, COMPLETE TWIST & TIE TO SECOND BRK'T. ON REFLECTOR ASSY. (8) LOCATIONS	PLIERS			2.80										
30	TWIST WIRE AS REQ'D. ROUTE THRU ATTACHMENT BRACKET, COMPLETE TWIST & TIE TO SECOND BRK'T. ON REFLECTOR ASSY. (40) LOCATIONS	PLIERS			14.00										
TOTALS SUBTOTALS - OPER 110					21.80	2,000									
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLY. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY.	OPER. NO.					
		INDUSTRIAL ENGR.	LAB.	QUAL. CONTR.	PLY. ENGR.	PRODN.	DAILY PLY. PLANNING VOLUME	REOMTS.	SUPERSEDES.	PC/HR.	HRS.	110			

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PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO.		PART NAME				ISSUE DATES		DEPARTMENT						
FOR MODELS FINAL FIELD ASSEMBLY		REMOVAL HELIOSTAT ASSY. FROM FIXTURE				9/9/80		PART NO.						
		MATERIAL		WT./	RGH.	FIN.	RELEASE		SHEET 1 OF 1					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQ.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRVOLT	
10	UNCLAMP TORQUE TUBE (2) CLAMPS.	FINAL ASSY. FIXTURE			20	(FROM OPER. #10)								
20	UNCLAMP GIMBAL - (4) CLAMPS	MANUAL			40									
20	ATTACH SPECIAL HANDLING DEVICE AND REMOVE COMPLETE HELIOSTAT ASSY. FROM FIXTURE AND TRANSFER TO FIELD TRANSPORT DOLLIE.	SPECIAL HANDLING DEVICE			4.00									
TOTALS		SUBTOTAL OPER 120			4.60									
REMARKS														
		PROCESS ENGR.	PLY. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLY. ENGR.	PRODN.	DAILY PLY. PLANNING							

Std. Mfg. Development Engrg. & Research

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PROCESS ESTIMATE SHEET

PLANT _____		PROGRAM OR ECR NO.				PART NAME FRAME SUB ASSY				ISSUE DATES				DEPARTMENT:			
FOR MODELS FINAL FIELD ASSEMBLY		MATERIAL DIR. LAB. STDS. RECAP				WT./ LBS.    RGM.    FIN.				PART NO.				RELEASE		SHEET 2 OF 3	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST			
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. PRYCAT				
50					14.60												
60					3.40												
70					20.20												
80					5.80												
	SUBTOTAL				44.00												
	PERSONAL RELIEF				2.95												
TOTALS					46.95												
REMARKS																	
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO.						
		INDUSTRY ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR.    HRS.	SUPERSEDES:								

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PROCESS ESTIMATE SHEET

PLANT _____		<b>PROCESS ESTIMATE SHEET</b>										DEPARTMENT _____	
PROGRAM OR ECR NO.		PART NAME ASSEMBLE REFLECTOR ASSYS TO SUPPORT BEAMS						ISSUE DATES		PART NO.			
FOR MODELS FINAL FIELD ASSEMBLY		MATERIAL DIR. LAB. STANDARDS RECAP				WT./ LBS.	RGH.	FIN.	RELEASE		SHEET 3 OF 3		
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	
90					67.20								
100					44.40								
110					21.80								
120					4.60								
	SUBTOTAL				138.00								
	PERSONAL RELIEF				9.25								
TOTALS					147.25								
REMARKS GRAND TOTAL FIELD ASSY - 202.4													
		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.			
		INDUSYR. ENGR. S. LEWIS	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/HR. HRS.	SUPERSEDES:				

*Stow* Mfg. Development Engrg. & Research

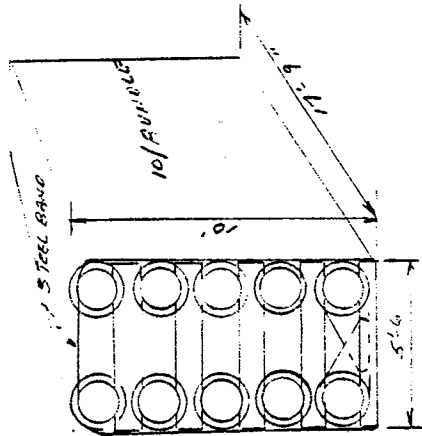
A-329

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PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO.		PART NAME				ISSUE DATES		DEPARTMENT							
		INSTALL HELIOSTAT ASSY. TO PEDESTAL				9/10/80		PART NO. REF. 531437, SM-1657							
FOR MODELS		MATERIAL			WT./LBS.	RGH.	FIN.	RELEASE		SHEET OF					
FIELD INSTALLATION										OF					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S RECD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRV/DJT		
	PARTS REQ'D: (1) HELIOSTAT ASSY. (9) NUTS & WASHERS														
10	TRANSPORT HELIOSTAT ASSY TO INSTALLATION SITE	TRANSPORT DOLLIES			IND. LAB	SEE MAT'L	HANDLING								
20	LIFT HELIOSTAT ASSY FROM TRANSPORT DOLLIE AND POSITION OVER STUDS ON PEDESTAL	SPECIAL HANDLG. DEVICE	2		10.00					8,000					
30	LOOSE ASSEMBLE (9) NUTS & WASHERS & SECURE WITH POWER TOOL	PNEUMATIC NUTRUNNER			2.70	4,000									
40	RELEASE HANDLING DEVICE				.50										
50	CONNECT WIRING				4.00										
60	RETURN TRANSPORT DOLLIES TO FIELD ASSY. BLDG.				IND. LAB										
	PERSONAL RELIEF				1.15										
TOTALS					SUBTOTAL FIELD INSTALLATION		18.35								
REMARKS															
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:		OPER. NO.		10		
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODH.	DAILY PLT. PLANNING VOLUME	REQMTS.	PC/HR.	HRS.	SUPERSEDES.				

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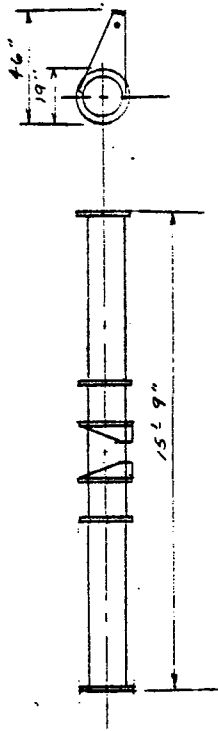


OUTSIDE SPACING REQ'D. - 5 DAYS 2 1/2 SWITZ = 1040

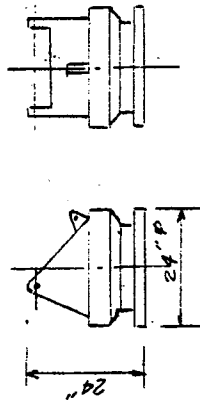
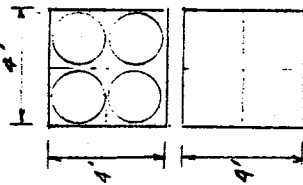
TORQUE TUBE - 104 BUNDLES - 2 HIGH = 11,000 M (11,000 M)

AZIMUTH - 130 BEAMS - 8 HIGH = 1,500 M

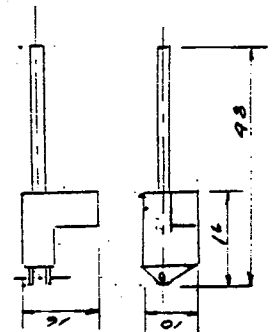
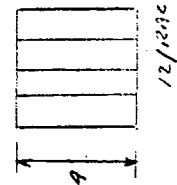
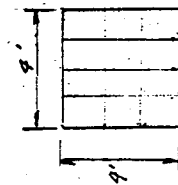
ELEVATOR - 87 BEAMS - 5 HIGH = 1,000 M



TORQUE TUBE ASSY

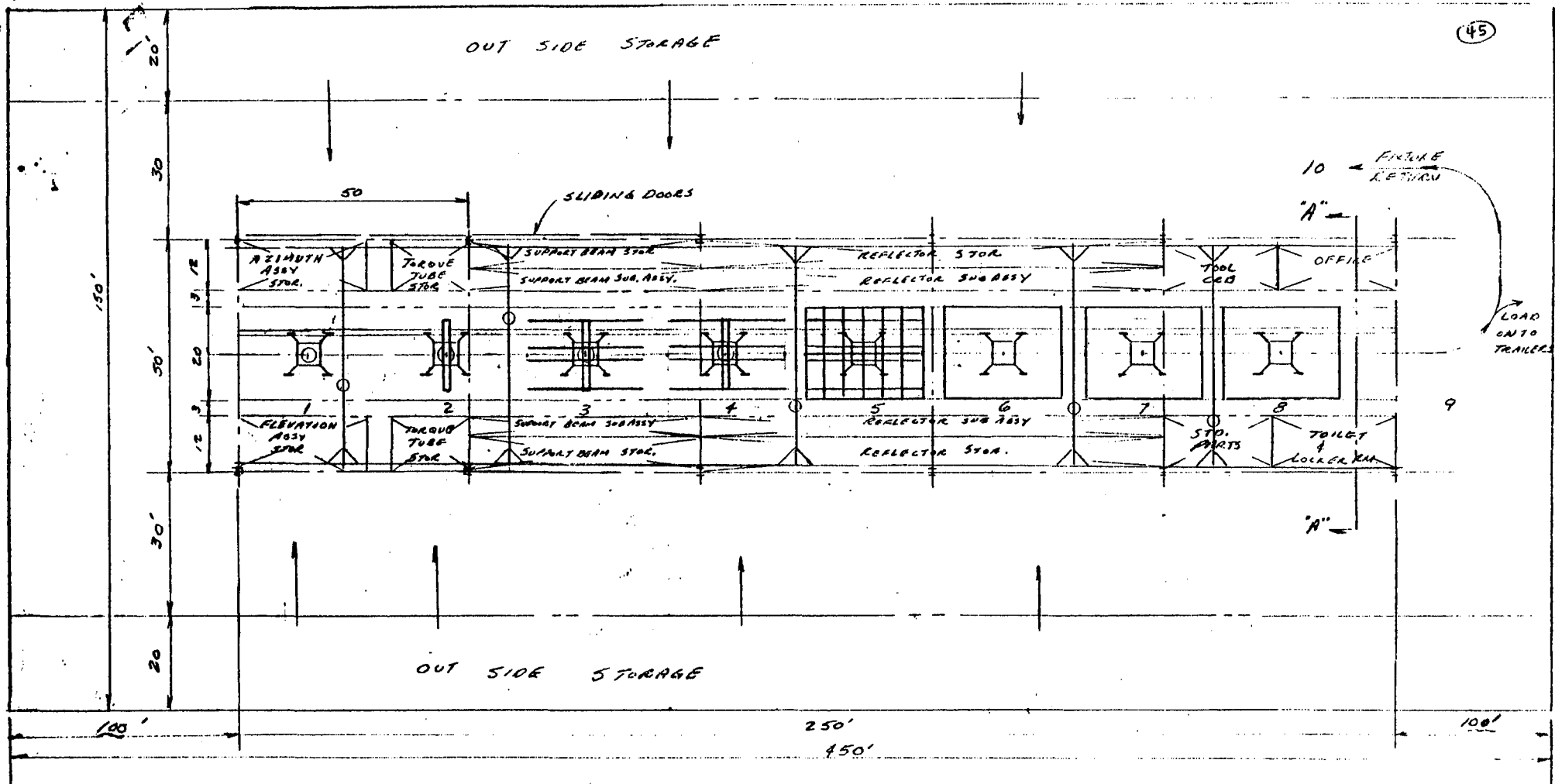


AZIMUTH ASSY



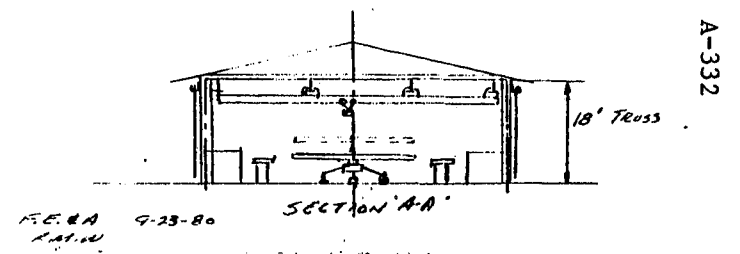
ELEVATION ASSY





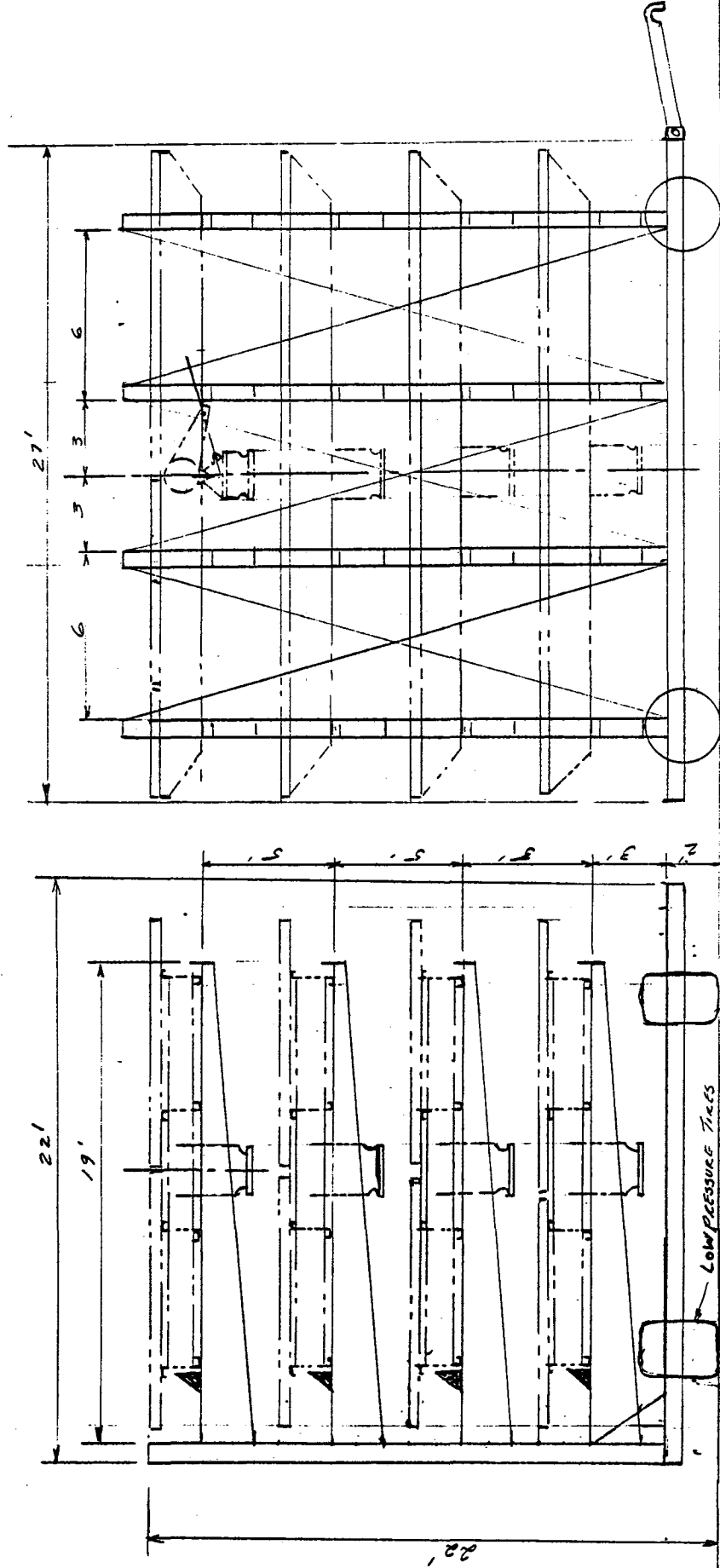
- 1 BOLT AZIMUTH ASSY TO FIXT. ASSY ELEVATION ASSY TO AZIMUTH.
- 2. ASSY TORQUE TUBE TO AZIMUTH & ELEVATION ASSY
- 3 & 4 ASSY SUPPORT BEAMS TO TORQUE TUBE.
- 5-8 ASSY REFLECTORS TO SUPPORT BEAMS & LOCK WARE.
- 9- REMOVE FROM FIXT & PLACE ON TRAILER.
- 10- RETURN FIXT TO START OF LINE.

HELIOSTAT  
FIELD ASSEMBLY BUILDING.  
SCALE 1/2" = 10'



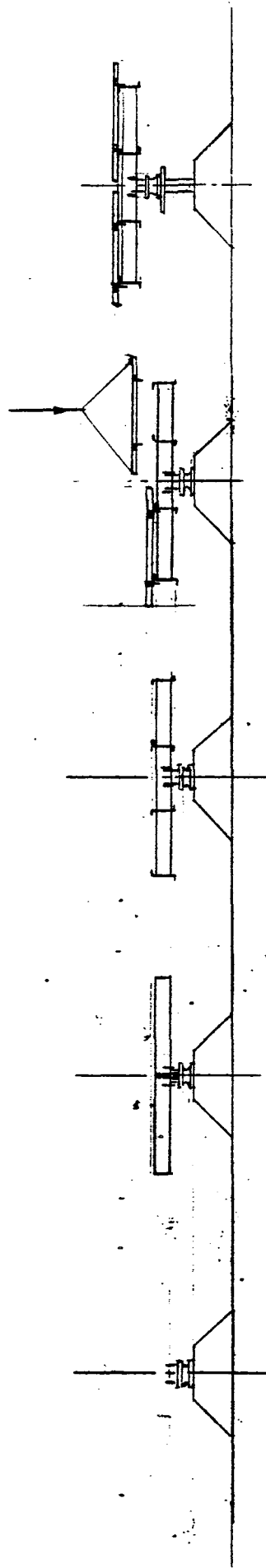
A-332

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HELIOSTAT ASSEMBLY TRANSPORTING TRAILER.

F. E. A 9-25-80  
F. M. M.



ASSY. AZIMUTH TO  
FITURE

ASSY. ELEVATION & TORQUE  
TO AZIMUTH ASSY.

ASSY. SUPPORT BEAMS TO  
TORQUE TUBE

ASSY REFLECTOR TO SUPPORT  
BEAMS

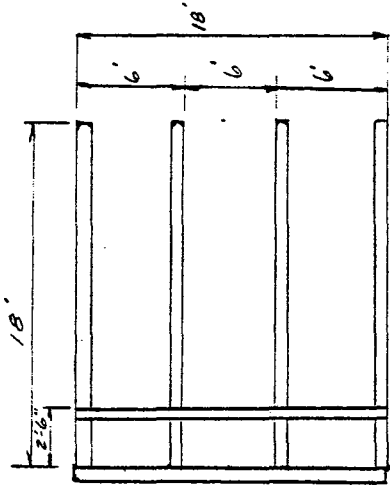
RAISE FITURE & SECURE  
REFLECTORS TO SUPPORT BEAMS  
& LOCK WIGG.

PROPOSED ASSEMBLY SEQUENCE  
FOR HELIOSTAT.

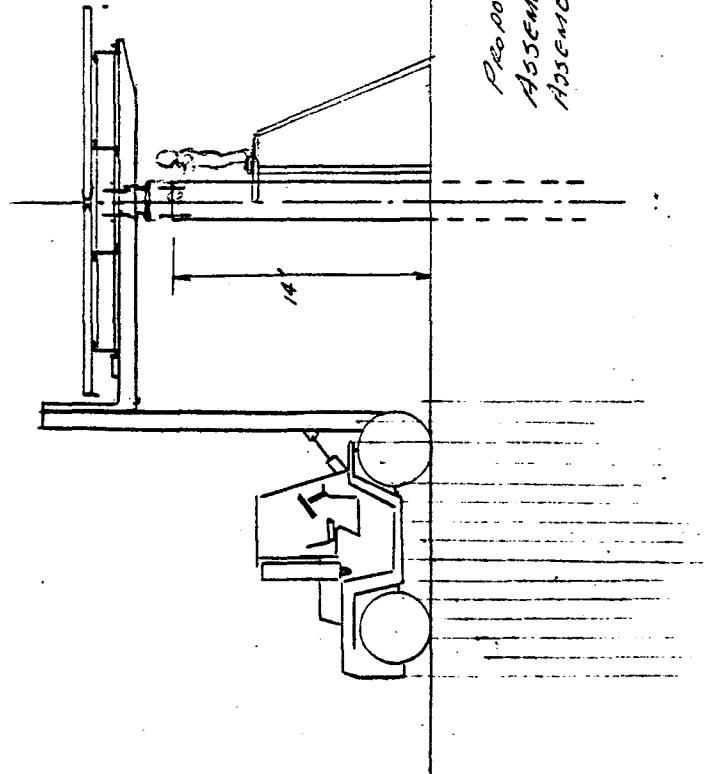
A-334.

F M & A 9-23-80  
K.M.N.

(45)



SPECIAL FORS BEAD  
PLANVIEW.



PROPOSED METHOD FOR  
ASSEMBLING THE HELIOS 717  
ASSEMBLY TO THE PEDESTAL.

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F. M. H. 9-25-80  
R. M. N.

APPENDIX B

## Heliostat Manufacturing Study

SUPPORT DEPARTMENTS AND SYSTEMS

Data is included on the following support departments and systems:

- o Material Handling and Industrial Vehicles: B-2
  - Manufacturing Plant (Sheets 1 & 2)
  - Field Assembly (Sheet 1)
- o Quality Control Department: B-5
  - Chemical Laboratory (Sheet 1)
  - Gear Inspection/Laboratory (Sheets 2 & 3)
  - Layout, Tool, Gage & Receiving Inspection (Sheet 4)
  - Physical Laboratory (Sheet 5)
  - Metallography Laboratory (Sheet 6)
- o Maintenance - General Facilities (Sheet 1) B-11
- o Tool Room Facilities (Sheet 1 thru 3) B-12
- o Cutter Sharpening Facilities (Sheets 1 and 2) B-15
- o General Stores - Parts & Tool Storage (Sheet 1) B-17
- o Parts Washing Operations (Sheet 1) B-18
- o Heat Treat Facilities (Sheet 1) B-19
- o Galvanizing System B-20
  - Galvanizing Material Cost Estimate
  - Galvanizing Operation
  - Sketch of Torque Tube/Support Arms
- o Optional Paint System B-23
  - Paint System
  - Investment Cost
  - Paint Facility Layout

PROCESS ESTIMATE SHEET

OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR QTY. NUMBER	MACHS. HOURLY CAP.	EST. MINUTES	FACILITY AND DURABLE TOOL COST			SPECIAL TOOL COST			UPPER COST
					TOTAL	BASIC	INSTALLATION	TOTAL	DESIGN	CONSTR.	
	FORK TRUCK (YARD) 10,000 CAPACITY		2	30	70,000						
	FORK TRUCK 6,000 CAPACITY		4	30	120,000						
	FORK TRUCK 4,000 CAPACITY		2	30	54,000						
	TOW TRUCK 4,000 CAP		3	30	36,000						
	BILLET TRUCK 4,000 CAPACITY		6	30	18,000						
	BATTERIES 300V		12	30	10,800						
	BATTERY CHARGERS		6	30	7,200						
	STEEL TRUCKERS		20	30	11,000						
	STEEL RACKS		100	30	18,000						
	WIRE BINS		200	30	20,000						
	SHELVING & CABINETS				5,000						
	TRENCH DOOR EQUIPMENT		6	30	2,000						
	HAND TRUCKS		6	30	3,000						
	DRUM TRUCKS		5	30	5,000						
	CHOP HORRERS (2 CONE YARD QUANT)		100	30	1,000						
	PALLETS		500	30	15,000						
	CASTING SHARPING RACKS										
TOTALS											
REMARKS											

DEPARTMENT:	ISSUE DATES:	RELEASE:	SHEET:	OF:
	9-25-80		1	2
PROGRAM OR TRM NO.	PART NAME	WT. LBS.	RGH. FIM.	OPER. NO.
HELIOSTAT (MFG. PLANT)	MATERIAL HANDLING AND INDUSTRIAL VEHICLES			
FOR MODELS	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR QTY. NUMBER	MACHS. HOURLY CAP.	EST. MINUTES	REQ'D. PER VEHICLE
50,000 Vol.				
PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	VAL. HDLG. ENGR.
INDUSTRIAL ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.
			DIWANESEAN	
REMARKS:	DAILY SERVICE	DAILY PLY. PLANNING VOLUME	REQUIS. PC/MR.	HRS.
Mfg. Development Engng. & Research				

**PROCESS ESTIMATE SHEET**

PLANT		PROGRAM OR EEN NO. <b>HELIOSTAT (MFG. PLANT)</b>					PART NAME <b>MATERIAL HANDLING AND</b>			ISSUE DATE <b>9-25-80</b>			DEPARTMENT					
FOR MODELS <b>50,000 VOL.</b>		MATERIAL <b>INDUSTRIAL VEHICLES</b>					WT./LBS.			RGH. FM.			PART NO.		RELEASE		SHEET <b>2</b> OF <b>2</b>	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'Y REQ.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST				
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRYS/ST					
	<b>TRASH RECEPTILES</b>		<b>10</b>			<b>500</b>												
	<b>SIGNAL STACK CARTS</b>		<b>10</b>			<b>5,000</b>												
	<b>SHIPPING DUNNAGE</b>					<b>25,000</b>												
<b>TOTALS</b>						<b>506,700</b>												
<b>REMARKS</b>																		
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	NATL. MDLG. ENGR.	DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:		OPER. NO.					
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLT. PLANNING VOLUME		REQNTS. PC/HR. HRS.		SUPERSEDES:							

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PROCESS ESTIMATE SHEET

PLANT		PROGRAM ORDER NO.		PART NAME		ISSUE DATES		DEPARTMENT					
HELIOSTAT (FIELD ASSY)		50,000 Vol		MATERIAL HANDLING AND INDUSTRIAL VEHICLE		9-25-60		PART NO.					
FOR MODELS		WT. LBS.		RGN. F.M.		RELEASE		SHEET 1 OF 1					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACH. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST			SPECIAL TOOL COST			EXCESSIVE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN		BUILD
	FORK TRUCK 20,000* CAPACITY		3		DESIGN	210,000							
	FORK TRUCK (YARD) 10,000* CAPACITY		1		DESIGN	35,000							
	FORK TRUCK (YARD) 6,000* CAPACITY		2		DESIGN	60,000							
	TON TRUCK 4000* CAP		2		DESIGN	24,000							
	PICKUP TRUCKS (MANUAL) 9000*		4			2,000							
	STOCK TRAILERS		10			4,500							
	STEEL RACKS & PANS		40			7,200							
	COMPLETE ASSY TRAILER		20			600,000 (30,000)							
TOTAL FOR ONE ASSY SITE						997,200							
TOTAL FOR TWO ASSY SITES						1,994,400							
TOTALS													
REMARKS													

Mfg. Development  
Engg. & Research



**PROCESS ESTIMATE SHEET**

PLANT _____		<b>PROCESS ESTIMATE SHEET</b>				DEPARTMENT _____								
PROGRAM OR EEN NO. <i>HELIOSTAT</i>		PART NAME <i>QUALITY CONTROL</i>			ISSUE DATES <i>9-8-80</i>		PART NO. <i>PLANT WIDE</i>							
FOR MODELS _____		MATERIAL <i>CHEMICAL LABORATORY</i>		WT. LBS.	RGH.	FM.	RELEASE							
							SHEET <i>1 of 6</i>							
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'Y REQ'D.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD		INST. TOYS, ETC.
	<i>ANALYTIC BALANCE AND WEIGHTS</i>		<i>1</i>							<i>2200</i>				
	<i>MAGNIA GAGE</i>		<i>1</i>							<i>2100</i>				
	<i>VISCOSITY BATH AND ACCESSORIES</i>		<i>1</i>							<i>1600</i>				
	<i>CENTRIFUGE AND ACCESSORIES</i>		<i>1</i>							<i>3300</i>				
	<i>P.H. METER</i>		<i>1</i>							<i>2100</i>				
	<i>CARBON ANALYSER</i>		<i>1</i>							<i>2100</i>				
	<i>LECO H.F. FURNACE</i>		<i>1</i>							<i>3000</i>				
	<i>TITRATOR (LIQUID ANALYSER)</i>		<i>1</i>							<i>2100</i>				
	<i>BLOCK FURNACE (SCOTT TESTER)</i>		<i>1</i>							<i>3600</i>				
	<i>REFRIGERATOR</i>		<i>1</i>							<i>1500</i>				
	<i>MUFFLE FURNACE AND ACCESSORIES</i>		<i>1</i>							<i>1500</i>				
	<i>ULTRASONIC CLEANER</i>		<i>1</i>							<i>1500</i>				
	<i>CHEMICAL BENCH WITH ACCESSORIES INCLUDING HOOD, SINK, ELECTRICAL OUTLETS, WATER, DRAINS, ETC.</i>									<i>20,000</i>				
	<i>MISC. EQUIPMENT: HOT PLATES, BURNERS, TEST TUBES, TABLES, CABINETS, RACKS, TRAYS, ETC.</i>									<i>15,000</i>				
	<i>TOTAL FREIGHT &amp; INSTALLATION</i>		<i>lot</i>						<i>10,000</i>		<i>1000</i>	<i>9000</i>		
<b>TOTALS</b>						<i>10,000</i>				<i>61,600</i>				
<b>REMARKS</b> <i>FLOOR SPACE 2000 sq. FT.</i>														
		PROCESS ENGR. <i>OHANESIAN</i>	PLT. LAYOUT	AUTOMATION	DESIGN	MAT'L. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
	<i>Mfg. Development Engrg. &amp; Research</i>	INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR. <i>OHANESIAN</i>	PRODN.	DAILY PLT. PLANNING VOLUME	REQ'TS. PC/NR. NRS.	SUPERSEDES:					

PROCESS ESTIMATE SHEET

PROGRAM OR CER NO. HELIOSTAT		PART NAME QUALITY CONTROL				ISSUE DATES 9-8-80		DEPARTMENT GEAR MACHINING						
FOR MODELS		MATERIAL GEAR INSPECTION		WT. LBS.	RGH.	FM.	RELEASE	SHEET 2 OF 6						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. BUY/QT	
	INSPECTION OF GEARS IN MACHINING AREAS:													
	INVOLUTE PROFILE CHECKING MACHINES		4		25,000 EA.	119,000	109,000	2,000	8,000	56,000	14,000	EA.		
	LEAD MEASURING MACHINES		4		33,500 EA.	147,000	134,000	3,000	10,000	168,000	42,000	EA.		
	TOOTH SPACE COMPARATORS		4		15,000 EA.	65,500	60,000	1,500	4,000	56,000	14,000	EA.		
	GENR. ROLLING FIXTURES & GAGES		8		1,200 EA.	11,500	10,000	500	1,000	12,000	1,500	EA.		
	TABLES, CABINETS, RACKS, STANDS		10T			13,000	10,000	100	2,000					
	HOISTS & SERVICE RAILS					18,500	12,000	500	6,000	3,000				
TOTALS						365,500				295,000				
REMARKS FLOOR SPACE 20.00 Sq.Ft.														
PROG. ENGR. OHANESIAN		PLT. LAYOUT		AUTOMATION		DESIGN		MATH. MDLG. ENGR.		DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:
INDUSTR. ENGR.		LAB.		QUAL. CONTR.		PLT. ENGR. OHANESIAN		PRODN.		DAILY PLT. PLANNING VOLUME		REQMTS. PC/MR. HRS.		SUPERSEDES:
Mfg. Development Engrg. & Research														

**PROCESS ESTIMATE SHEET**

PLANT _____		<b>PROCESS ESTIMATE SHEET</b>					DEPARTMENT _____							
PROGRAM OR ECR NO. <i>HELIOSTAT</i>		PART NAME <i>QUALITY CONTROL</i>			ISSUE DATES <i>9-8-80</i>		PART NO. <i>GEAR MACHINING</i>							
FOR MODELS _____		MATERIAL <i>GEAR LABORATORY</i>		WT./LBS.	RGH.	FM.	RELEASE	SHEET <i>3</i> OF <i>6</i>						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD		INST. BYCAT
	<i>INVOLUTE PROFILE CHECKING MACHINE</i>		<i>2</i>				<i>50,000</i>			<i>28,000</i>				
	<i>LEAD MEASURING MACHINE</i>		<i>2</i>				<i>67,000</i>			<i>84,000</i>				
	<i>TOOTH SPACE COMPARATOR</i>		<i>2</i>				<i>30,000</i>			<i>28,000</i>				
	<i>ELECTRONIC RECORDER</i>		<i>2</i>				<i>18,000</i>							
	<i>GEAR ROLLING FIXTURE</i>		<i>2</i>				<i>2,400</i>			<i>2,000</i>				
	<i>DISC. TABLES, STANDS, CABINETS, RACKS.</i>		<i>LOT</i>											
	<i>HOISTS &amp; SERVICE RAIL</i>													
<b>TOTALS</b>						<i>167,400</i>				<i>143,000</i>				
REMARKS <i>FLOOR SPACE 1000 SQ.FT.</i>														
	PROCESS ENGR. <i>ONANESIAN</i>	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.					
	INDUSYR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR. <i>ONANESIAN</i>	PRODN.	DAILY PLT. PLANNING VOLUME	REQ'DYS. PC/HR.	SUPERSEDES:						

Mfg. Development  
Engrg. & Research

PROCESS ESTIMATE SHEET

PLANT		PROCESS ESTIMATE SHEET										DEPARTMENT		
PROGRAM OR EER NO. HELIOSTAT		PART NAME QUALITY CONTROL					ISSUE DATES					PART NO. PLANT WIDE		
FOR MODELS		MATERIAL LAYOUT, TOOL, GAGE & REC'G INSPECTION					WT. LB.    RGH.    F.W.					RELEASE	SHEET 4 OF 6	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'T REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD		INST. TRVCS
	3 AXIS MEASURING MACHINE		1			85,000	78,000	2,000	5,000	27,000				
	30" OPTICAL COMPARITOR		1			19,000	17,000	500	1,500	6,000				
	14" OPTICAL COMPARITOR		1			11,500	10,000	500	1,000	4,000				
	GRANITE SURFACE PLATES		4			13,500	12,000	500	1,000					
	HORIZONTAL COMPARITOR (HOLE CHECKER)		1			11,200	10,000	200	1,000	4,000				
	24" INDEX PLATE		1			9,600	9,000	100	500	3,000				
	DIVIDING HEAD, TAIL STOCK & STAND		1			23,200	22,000	200	1,000	7,000				
	INDICORDER (ROUNDNESS CHECKER)		1			53,000	48,000	1,000	4,000	16,000				
	TORQUE WRENCH CHECKER		1			3,500	3,500	-	-					
	PROFILOMETER		2			7,600	6,500	100	500					
	ELECTRONIC COMPARITOR		2			11,100	10,000	100	1,000	5,000				
	MISC. EQUIPMENT & PRECISION INSTRUMENTS HEIGHT GAGES, GAGE BLOCKS, ANGLE PLATES DIAL INDICATORS ETC.		LOT			-	-	-	-	130,000.				
	WORK TABLES, CABINETS, RACKS, HOIST & RAIL		LOT			18,500	15,000	500	3,000	2,000				
TOTALS						266,700				204,000				
REMARKS FLOOR SPACE - 2000 Sq. Ft.														
Mfg. Development Engrg. & Research		PROCESS ENGR. OHANESIAN	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTRY ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESIAN	PRODN.	DAILY PLT. PLANNING VOLUME	REQM'TS. PC/HR.    NRS.	SUPERSEDES:					

**PROCESS ESTIMATE SHEET**

PLANT _____		<b>PROCESS ESTIMATE SHEET</b>						DEPARTMENT _____						
PROGRAM OR ECR NO. <b>HELIOSTAT</b>		PART NAME <b>QUALITY CONTROL</b>				ISSUE DATES <b>9-8-80</b>		PART NO. <b>PLANT WIDE</b>						
FOR MODELS _____		MATERIAL <b>PHYSICAL LABORATORY</b>		WT. LBS.	RGH.	FM.	RELEASE	SHEET <b>5</b> OF <b>6</b>						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				DEPEND. COST
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. TRAVEL	
	<b>HARDNESS TESTERS</b>		<b>4</b>							<b>11000</b>				
	<b>TENSILE TEST MACHINE</b>		<b>1</b>			<b>49000</b>	<b>45000</b>	<b>1000</b>	<b>3000</b>					
	<b>MAGNAFLUX UNIT WITH ACCESSORIES</b>		<b>1</b>			<b>22000</b>	<b>18000</b>	<b>1000</b>	<b>3000</b>					
	<b>BAND SAW</b>		<b>1</b>			<b>19,000</b>	<b>8500</b>	<b>500</b>	<b>1000</b>					
	<b>CAST IRON TABLES, CABINET, RACKS &amp; MISD. EQUIPMENT</b>		<b>LOT</b>			<b>7500</b>	<b>6000</b>	<b>500</b>	<b>1000</b>					
<b>TOTALS</b>						<b>89,500</b>				<b>11,000</b>				
REMARKS <b>FLOOR SPACE 800 SQ. FT.</b>														
	PROCESS ENGR. <b>OHANESIAN</b>	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NETV ASSY:	OPER. NO.					
	INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR. <b>OHANESIAN</b>	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS.	SUPERSEDES:						
							PC/HR.	HRS.						

Mfg. Development  
Engrg. & Research

PROCESS ESTIMATE SHEET

PLANT PROGRAM OR EER NO. HELIOSTAT		PART NAME QUALITY CONTROL		ISSUE DATES 9-8-80		DEPARTMENT PLANT WIDE													
FOR MODELS		MATERIAL METALLOGRAPHY LABORATORY		MT./LBS. RGN. FM.		RELEASE SHEET 2 of 6													
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. HOURLY REPR.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST		SPECIAL TOOL COST		EXPENS. COST									
						TOTAL	BASIC	FREIGHT	METAL-LATHING		TOTAL	DESIGN	BUILD	INST. PAYOFF					
	BAUSEN & LOEB - BALANOT METALLOGRAPH		1			22500	2000	500	2000	7000									
	BAUSEN & LOEB - DINAZOBA METALLOGRAPH		1			5100	4000	100	1000	1000									
	POLISHING APPARATUS (8" wheel)		2			2600	2000	100	500	500									
	BELT - SURFACE POLISHING		1			2600	2000	100	500										
	BETA SCOPE		1			7600	7000	100	500	1000									
	OUT OFF MACHINE		1			3100	2500	100	500										
	COATING TESTER & ANALYSER		1			36000	32000	1000	3000	1000									
	DRILL PRESS		1			1800	1200	100	500	500									
	MISC. EQUIPMENT, TABLES, CABINETS, BENCHES		107			10600	10000	100	500										
	MICROSCOPE		1			3600	3000	100	500	500									
<b>TOTALS</b>						93500													11500

REMARKS: FLOOR SPACE 1000 sq. ft. TOTAL: FAC. - 993,600  
 Q.C. TOOLS - 726,100  
 Q.C. EXP. - 0

PROCESS ENGR. DANESMAN	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. HDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASST.	OPER. NO.
INDUSTRIAL ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR. DANESMAN	PRODM.	DAILY PLT. PLANNING VOLUME	RECYCL.	SUPERVISOR:	
						PC/NR.	NRL	

Mfg. Development  
 Engrg. & Research

PROCESS ESTIMATE SHEET

PROGRAM OR ECR NO. HELIO STAT		PART NAME MAINTENANCE - GENERAL FACILITIES				ISSUE DATES 9-8-80		DEPARTMENT PLANT WIDE						
FOR MODELS		MATERIAL		WT. LBS.	RGH.	FM.	RELEASE	SHEET 1 OF 1						
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQ.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST?	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD		WST. TBYS/27
	THE FOLLOWING COSTS ARE FOR FACILITIES, EQUIPMENT AND MISCELLANEOUS TOOLS FOR THE VARIOUS SKILLED AND SEMI-SKILLED TRADES FOR THE MAINTENANCE OF THE MANUFACTURING FACILITIES, BUILDINGS AND GROUNDS.													
	MILLWRIGHT SHOP	20000				110,000								
	MACHINE REPAIR SHOP	18000				275,000								
	PIPE SHOP	5000				25,000								
	HYDRAULIC REPAIR SHOP	5000				55,000								
	SPINDLE REPAIR SHOP	5000				55,000								
	PAINT SHOP	5000				55,000								
	SHEETMETAL SHOP	1000				110,000								
	WELDING SHOP	2000				115,000								
	ELECTRICAL REPAIR AND ELECTRONIC LAB.		10000			300,000								
	CARPENTER SHOP	5000				55,000								
	LABOR GROUP	5000				35,000								
	BUILDINGS, GROUNDS AND SANITATION	30000				150,000								
TOTALS														
REMARKS						FLOOR SPACE - 9,000 SQ. FT.		1,340,000.						
	PROCESS ENGR. OHANESIAN	PLT. LAYOUT LAB.	AUTOMATION QUAL. CONTR.	DESIGN OHANESIAN	MATL. MDLG. ENGR.	DAILY SERVICE DAILY PLT. PLANNING VOLUME	REQ'D. PER VEHICLE PC/MR.	WKT ASSY: HRS.	SUPERSEDES:		OPER. NO.			

Mfg. Development  
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PROCESS ESTIMATE SHEET

PLANT PROGRAM OR CTR. NO. HELIOSTAT		PART NAME Tool Room Facilities		ISSUE DATES		DEPARTMENT RELEASE		SHEET 2 OF 3					
FOR MODELS		MATERIAL		MT./	RMH.	FACILITY AND DURABLE TOOL COST		SPECIAL TOOL COST					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR D.T. NUMBER	MAX. HOURLY CAP.	EST. MINUTES	TOTAL	BASIC	FREIGHT	INITIAL-LABOR	TOTAL	DESIGN	BUILD	EXCESS COST	
	DRILL - RADIAL ARM	5' X 11"	1		67,000	61,000	1,000	5,000					
	LATHE - 22" X 72"		1		87,500	81,000	1,500	5,000					
	LATHE 16" X 54"		1		67,000	61,000	1,000	5,000					
	LATHE - 13" X 13" X 36"	SPEED	2		82,000	75,000	1,000	6,000					
	INDEX TABLE 14"		1		4,100	4,100	-	-					
	LATHE UNIVERSAL TURRET		1		81,500	75,000	1,500	5,000					
	BAND SAW - 36"		1		12,200	11,000	200	1,000					
	MILLING MACHINE - UNIVERSAL		1		87,500	81,000	1,500	5,000					
	PEDESTAL GRINDER - 6"		2		12,000	10,000	-	200					
	PEDESTAL GRINDER - 10"		2		22,000	20,000	-	200					
	GRINDER - UNIVERSAL TOOL		1		94,500	88,000	1,500	5,000					
	GRINDER - INTERNAL		1		235,000	225,000	2,000	8,000					
	GRINDER - SURFACE - 8" X 12" X 24"		1		44,000	41,000	1,000	3,000					
	GRINDER - TOOL		1		5,800	5,200	100	500					
	GRINDER - PROFILE		1		16,200	15,000	200	1,000					
TOTALS					837,700								
REMARKS										NEXT ASSY.		OPER. NO.	
Mfg. Development					DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY.		OPER. NO.		
Engrg. & Research					DAILY PLT. PLANNING		REQ'TS. PC/NR.		SUPERSEDED:		OPER. NO.		
					DAILY VOLUME		PC/NR.		MRL.		OPER. NO.		

PROCESS ESTIMATE SHEET

PLANT PROGRAM OR CER NO. HELIOSTAT FOR MODELS	PART NAME TOOL ROOM FACILITIES	MATERIAL	ISSUE DATES		WT./LBS.	RSH. PM.	RELEASE	SHEET 3 OF 3				
			DEPARTMENT	PART NO.				DESIGN	MTY. (BY/DT)			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MAN. HOURS	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST		SPECIAL TOOL COST		SPECIAL COST		
						TOTAL	BASIC	FREIGHT	INSTALL-LABOR		TOTAL	DESIGN
	JIG GRINDER		1			23000	73000	2000	5000			
	GEAR HOBBER - UNIVERSAL		1			150000	150000	2000	8000			
	HARDNESS TESTER		1			3500	3500	100	500			
	MISC. TOOL ROOM GAGES, INSTRUMENTS - TOOL CRYS		LOT			10000	10000	2000	8000	150000		
	WORK BENCHES, TABLES, CABINETS, STANDS		LOT			11200	14000	200	1000			
	TOOL ROOM OFFICE SWIVEL EQUIPMENT					19000	15000	500	3000			
	DEMAGNETIZER					1300	1000	100	200			
	TOOLING FOR TOOL ROOM MACHINES									100000		
TOTALS						297600				250000		

REMARKS TOTALS: F - 1,517,200  
 T - 250,000  
 E - 0  
 1,767,200

INDUSY. ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	MENT ASSY.
LAB.	QUAL. CONTR.	PLT. ENGR.	PRODM.	DAILY PLY. PLANNING VOLUME	RECHTL. PC/MR.	SUPERSEDES:	OPER. MR.

Mfg. Development  
 Engng. & Research

**PROCESS ESTIMATE SHEET**

PLANT _____		<b>PROCESS ESTIMATE SHEET</b>						DEPARTMENT _____						
PROGRAM OR PERN. NO. <b>HELIOSTAT</b>		PART NAME <b>CUTTER SHARPENING FACILITIES</b>				ISSUE DATES <b>9-6-80</b>		PART NO.						
FOR MODELS		MATERIAL		WT./LBS.	RGH.	FM.	RELEASE		SHEET <b>1</b> OF <b>2</b>					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	METAL-LATION	TOTAL	DESIGN	BUILD	INST. TRYOUT	
	TOOL GRINDER - ELECTROLYTE - HAMMOND		2	54.000	122000	108000	4000	10000						
	TOOL GRINDER - MONOSET		2	21.500	48000	43000	1000	4000						
	TOOL GRINDER - B&S UNIVERSAL #13		1	4000	45000	40000	1000	400						
	TOOL GRINDER - #300 OLIVER		2	12000	26500	24000	500	2000						
	TOOL GRINDER - MANUAL - BLOUNT		3	7000	23000	21000	500	1500						
	DRILL GRINDER - CINCINNATI		2	20000	45000	40000	1000	4000						
	DRILL GRINDER 1-GA - SELLARS		4	4500	20500	18000	500	2000						
	DRILL TIP GRINDER #600 OLIVER		3	10.500	36500	31500	1000	4000						
	DRILL - SUBLAND GRINDER #308 HAWK		3	7000	23500	21000	500	2000						
	TOOL GRINDER - DOUBLE END - HAMMOND		2	16500	37000	33000	1000	3000						
	DRILL GRINDER - RADIAL LIP		1	34.000	37500	34000	500	3000						
	O.D. - I.D. GRINDER - B&S		1	57000	63000	57000	1000	5000						
	BELT SANDER - ROCKWELL		1	1100	1600	1100	100	200						
	OPTICAL COMPARATOR - PC. 14 - J&L		2	7000	16200	14000	200	2000						
	ABRASIVE CUT OFF - DELTA		1	2200	2800	2200	100	500						
<b>TOTALS</b>			27		<b>548,100</b>									
REMARKS <b>CUTTER SHARPENING FLOOR SPACE 7,500 Sq. FT.</b>														
Mfg. Development Engrg. & Research		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	NATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR. OHANESIAN	PRODN.	DAILY PLT. PLANNING VOLUME	RECHTS. PC/NR. NRS.	SUPERSEDES:					

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PROCESS ESTIMATE SHEET

PLANT		PROGRAM OR TR. NO.		PART NAME		MATERIAL		ISSUE DATES		DEPARTMENT			
HELIOSTAT		CUTTER SHARPENING FACILITIES		CUTTER SHARPENING FACILITIES		CUTTER SHARPENING FACILITIES				PART NO.			
FOR MODELS										SHEET 2 OF 2			
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH. REQS.	NET HOURLY CAP.	EST. MINUTES	FACILITY AND DURABLE TOOL COST			SPECIAL TOOL COST			EXPEND. COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN		BUILD
	HEARING TOOL SHARPENER - FELLOWS		2			222000	203000	4000	15000				
	GENE SHAPER TOOL SHARPENER - FELLOWS		2			222000	203000	4000	15000				
	INDUSTRIAL BRAZER	PHILIPS	1			12500	10000	500	2000				
	DEMAGNATIZER		1			1200	1000		200				
	TAP GRINDER - ROYAL DAK		1			27200	25000	200	2000				
	MISC. TOOL GRINDING GAGES, HAND TOOLS LOT					20000	10000	2000	8000				130000
	WORK BENCHES, TABLES, CANNERS, STANDS		LOT			11200	10000	2000	1000				
	CUTTER SHARPENING - OFFICE EQUIPMENT		LOT			19000	15000	1000	3000				
TOTALS						535100							130000

REMARKS TOTAL: FAC. - 1,083,200  
 TOOLS - 150,000  
 EXP. - 0  
 1,233,200

Mfg. Development  
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**PROCESS ESTIMATE SHEET**

PLANT: _____		<b>PROCESS ESTIMATE SHEET</b>						DEPARTMENT: _____						
PROGRAM OR ECR NO. <i>HELIOSTAT</i>		PART NAME <i>PURCHASE FINISHED PARTS &amp; TOOL STORAGE</i>				ISSUE DATES <i>9-18-80</i>		PART NO. <i>ALL PARTS</i>						
FOR MODELS		MATERIAL <i>GENERAL STORES</i>		WT. I LBS.	RGH.	FIN.	RELEASE		SHEET <i>1</i> OF <i>1</i>					
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST			EXPENSE COST	
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD		INST. TRYOUT
	<i>PARTITIONING - 10'X10</i>					<i>4000</i>	<i>3000</i>		<i>1000</i>					
	<i>RACKS, SHELVES, BINS, CARTS, BOXES</i>					<i>12,000</i>	<i>8,000</i>		<i>4,000</i>					
	<i>TABLES</i>					<i>1,000</i>	<i>800</i>		<i>200</i>					
TOTALS														
REMARKS:						<i>17,000</i>								
		PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQ'D. PER VEHICLE	NEXT ASSY:	OPER. NO.				
		INDUSTR. ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR. <i>OHANESIAN</i>	PRODN.	DAILY PLT. PLANNING VOLUME	REQMTS. PC/NR. NRE.	SUPERSEDES:					

**WANKEL ENGINE TASK FORCE**

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PROCESS ESTIMATE SHEET

PLANT		PROGRAM OR TBR NO.		PART NAME		MATERIAL		ISSUE DATES		DEPARTMENT	
ALL PARTS		PARTS WASHING OPERATIONS		PARTS WASHING OPERATIONS		PLANT WIDE		9-16-80		ALL PARTS	
FOR MODELS		MT. 1		RGN. FIN.		RGN. FIN.		9-16-80		SHEET 1 OF 1	
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR B.T. NUMBER	MACH. REPR.	EST. MINUTES	MT. HOURLY CAP	FACILITY AND DURABLE TOOL COST	BASIC	PRELIM.	METAL LATION	SPECIAL TOOL COST	EXPENSE COST
TOTAL						TOTAL				TOTAL	
	CAST IRON MACHINING	(1) STAGE WASHER MANUAL CONVEYOR (2) WASH - RINSE - DRY CHIP REMOVAL CONV. IN WASH SECTION FILTER IN RINSE SECTION	1			270,000	250,000	20,000	15,000		
	STEEL MACHINING	(3) STAGE WASHER MANUAL CONVEYOR (1) WASH - RINSE - DRY	2			400,000	360,000	40,000	30,000		
	PURCHASED FINISHED PARTS	(2) STAGE WASHER MANUAL CONVEYOR WASH - DRY	1			170,200	150,000	20,000	15,000		
TOTALS						840,200					

REMARKS: FLOOR SPACE: 2400 sq. FT

PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. MDLG. ENGR.	DAILY SERVICE	REQD. PER VEHICLE	MTY. ASSY.	OPER. NO.
INDUSTRY ENGR.	LAB.	QUAL. CONTR.	PLT. ENGR.	PRODN.	DAILY PLY. PLANNING VOLUME	RECHTS. PC/MR.	SUPERSEDES:	
Mfg. Development				DANESIAU				
Engr. & Research								

PROCESS ESTIMATE SHEET

PLANT: \_\_\_\_\_ DEPARTMENT: \_\_\_\_\_

PROGRAM OR ECR NO. <i>HELIOSTAT</i>		PART NAME <i>HEAT TREAT FACILITIES</i>				ISSUE DATES <i>9-17-90</i>			PART NO. <i>VARIOUS</i>					
FOR MODELS		MATERIAL				WT./LBS.	RGH.	FIN.	RELEASE	SHEET <i>1</i> OF <i>1</i>				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACH'S REQS.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				EXPENSE COST
						TOTAL	BASIC	FREIGHT	INSTAL-LATION	TOTAL	DESIGN	BUILD	INST. TAYOUT	
	<i>CARBURIZING</i>	<i>FURNACE</i>	<i>2</i>		<i>Fac.</i>	<i>225000</i>	<i>200000</i>	<i>5000</i>	<i>20000</i>	<i>70000</i>				
		<i>QUENCH</i>	<i>2</i>		<i>Fac.</i>	<i>62000</i>	<i>50000</i>	<i>2000</i>	<i>10000</i>	<i>10000</i>				
		<i>DRAW FURNACE</i>	<i>1</i>		<i>Fac.</i>	<i>47000</i>	<i>35000</i>	<i>2000</i>	<i>10000</i>	<i>10000</i>				
	<i>CLEANING</i>	<i>WASHER - 2 STAGE MESH BELT</i>	<i>1</i>		<i>P.E.</i>	<i>62000</i>	<i>50000</i>	<i>2000</i>	<i>10000</i>					
	<i>QUALITY CONTROL</i>	<i>HARDNESS TESTERS &amp; ANALYSERS</i>			<i>Q.C.</i>	<i>4500</i>	<i>3000</i>	<i>500</i>	<i>1000</i>	<i>9000</i>				
		<i>BENCH GRINDERS TABLES - RACKS &amp; CABINETS</i>	<i>2</i>		<i>Q.C.</i>	<i>300</i>	<i>100</i>		<i>200</i>					
		<i>ZYGLO UNIT</i>	<i>1</i>		<i>Q.C.</i>	<i>6500</i>	<i>5000</i>	<i>500</i>	<i>1000</i>					
TOTALS										<i>33000</i>				
REMARKS: <i>HEAT TREAT FLOOR SPACE = 6000 SQ. FT.</i>														
PROCESS ENGR.		PLT. LAYOUT		AUTOMATION		DESIGN		NATL. MDLG. ENGR.		DAILY SERVICE		REQ'D. PER VEHICLE		OPER. NO.
INDUSTR. ENGR.		LAB.		QUAL. CONTR.		PLT. ENGR. <i>OHANESIAN</i>		PRODN.		DAILY PLT. PLANNING VOLUME		REQMTS. PC/HRS. HRS.		SUPERSEDES:

 WANKEL ENGINE TASK FORCE

GALVANIZING SYSTEM

Summary of estimated cost of material to plate each assembly:

Torque Tube/Flanges/Rings	36.4 lbs
Arm Assembly	4.7
Refl. Panel H-Frame Ass'y.	7.1
Refl. Panel Attachment Brackets	6.0
Attachments for Sensors	0.6
	<hr/>
	54.8 lbs.

(54.8 lbs + 11% Waste) @ 38¢/lbs = \$24/Unit

Initial charge of galvanizing tank = \$141,000

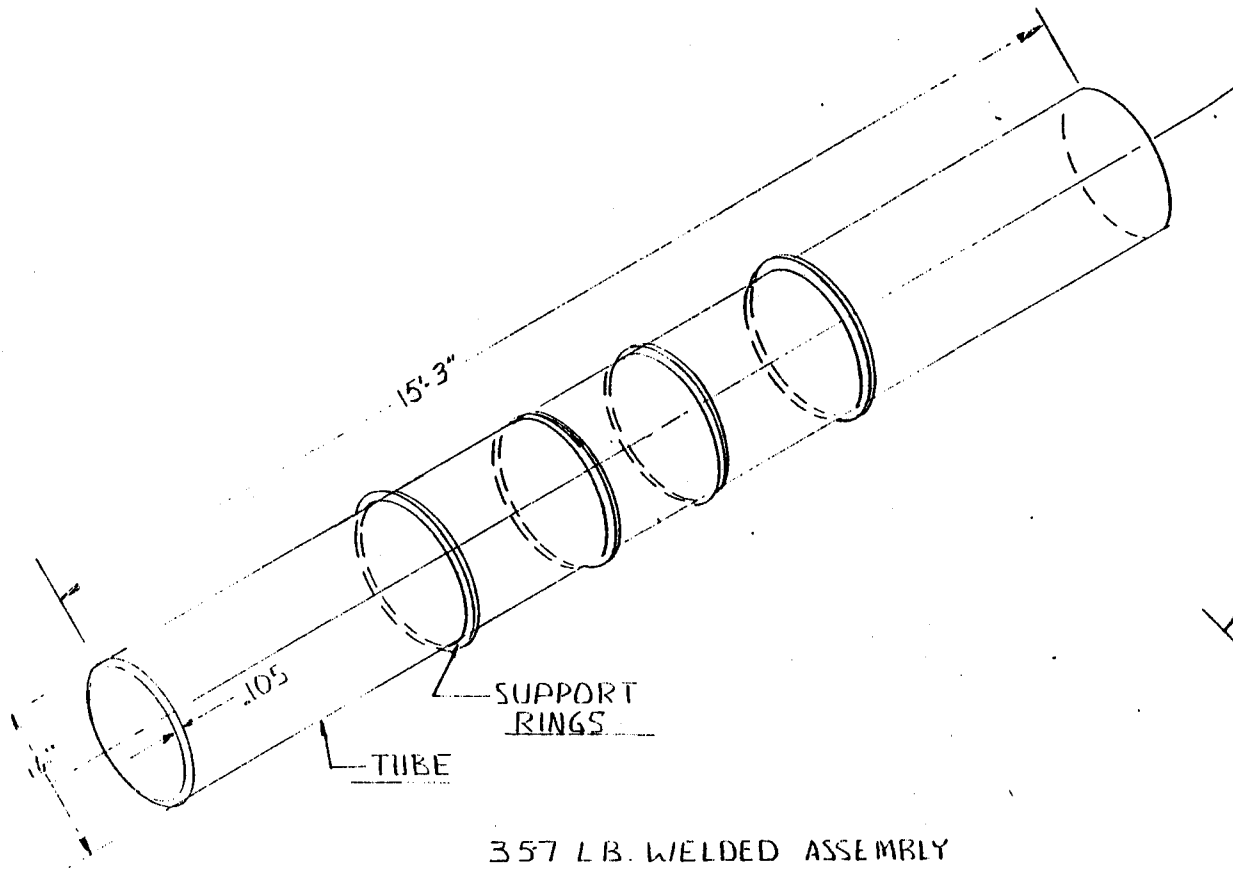
Initial charge of pickling tank = \$ 12,000



GALVANIZING SYSTEM

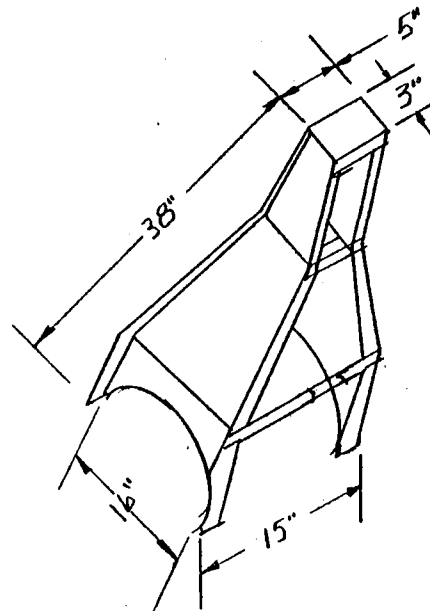
PROCESS ESTIMATE SHEET

PLANT PROGRAM OR TR. NO. FOR MODELS	OPERATION DESCRIPTION	PART NAME	ISSUE DATES			DEPARTMENT	SHEET 1 OF 1		
			WT./LBS.	RGH. FIM.	9-23-80				
MATERIAL		PRESS SHOP GENERAL		ALL STAMPINGS			RELEASE		
OPER. NO.	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR D.T. NUMBER	NET HOURLY CAP	EST. MINUTES	TOTAL	BASIC	FREIGHT	METAL LATHE	SPECIAL TOOL COST	EST. COST
								TOTAL	
								DESIGN	
								BUILD	
								TEST.	
								(CYCLES)	
	GALVANIZE STEEL STAMPINGS AND FABRICATED ASSEMBLIES			425,000					
	SERIALIZED MATERIAL HANDLING			200,000					
	AIR FILTRATION FOR GALVANIZING TANK INCLUDING BAG HOUSE			175,000					
	VAPOR EXTRACTION FOR CLEANING TANKS			200,000					
	WASTE TREATMENT SYSTEM WITH RECYCLING OF HYDROCHLORIC ACID FOR PICKLING TANK			150,000					
	INSTALLATION			100,000					
	ESTIMATED MANPOWER		12.80						
	9-OPERATORS								
	1-SUPERVISOR								
	PERSONAL RELIEF		.85						
TOTALS				1,250,000					
REMARKS		FLOOR SPACE 210'x60' = 12,600 SQ. FT.							
Mfg. Development		INDUSTRIAL ENGR. S. LEWIS		AUTOMATION		DESIGN		MATERIAL ENGR.	
Engg. & Research		LAB.		QUAL. CONTR.		PLT. ENGR. OLANESAL		PRODUCTION	
		PLT. LAYOUT		DAILY SERVICE		REQ'D. PER VEHICLE		NEXT ASSY:	
		LAB.		DAILY PLY. PLANNING VOLUME		RECYCLES		SUPERSEDED:	



357 LB. WELDED ASSEMBLY

HOT DIP GALVANIZE PER ASTM-A385-76  
 TO 2.00 OZ./FT. OF SURFACE. MINIMUM 3.4 MIL.  
 INSPECT PER SECTION 6 OF ASTM A153-73.



SUPPORT ARM

42 LB. WELDED ASSEMBLY

HELIOSTAT  
 TORQUE TUBE & RING ASS'Y  
 SUPPORT ARM ASS'Y

J. DHANESIAN · 3-15-80

## Heliostat Manufacturing Study

PAINT SYSTEM

Foundry castings will require a cleaning process to remove sand, scale and rust followed by an iron phosphate coating and a dip coat primer paint. Dip primer paint must be compatible with final protective coatings such as an air dry epoxy zinc chromate. Following machining and assembly operations at the Heliostat Manufacturing Plant the azimuth drive assembly and the elevation drive arm assembly will be given a manual solvent wipe prior to application of final protective coatings.

Final protective coatings will be applied to all outside surfaces of the azimuth drive assembly and the elevation drive arm assembly. Suggested materials for these protective coatings will consist of a prime coat of epoxy chromate followed by a baking cycle, returning through the paint booth a second time for application of a topcoat of acrylic urethane color again followed by a second baking cycle. Sample specifications of these materials are attached.

The paint system will consist of the following equipment: sidedraft "waterwash" spray booth with air make-up system, solvent flash-off enclosure, infra-red paint drying oven and an overhead monorail conveyor arranged approximately as shown on the attached layout.

Paint usage, material cost and paint system investment cost are detailed below:

Material - Surface area of both components is estimated at approximately 20 ft.<sup>2</sup>.

Primer (Ditzler DP-40) @ 1 mil (.001") thick

- . Coverage per gallon = 335 ft.<sup>2</sup>
- . Usage per unit = 20/335 = .060 gals.
- . Allowance for losses and overspray @ 100% = .060 gals.
- Total primer usage = 0.120 gals.
- . Price per gallon = \$12.53/gallon
- Primer material cost = 0.120 x \$12.53 = \$1.504/unit

Topcoat (Deltron Acrylic Urethane) @ 2 mil (.002") thick.

- . Coverage per gallon = 220 ft.<sup>2</sup>
- . Usage per unit = 20/220 = .091 gals.
- . Allowance for losses and overspray @ 100% = .091 gals.
- Total topcoat usage = 0.182 gals.
- . Price per gallon = \$21.79/gallon
- Topcoat material cost = 0.182 x \$21.79 = \$3.966/unit

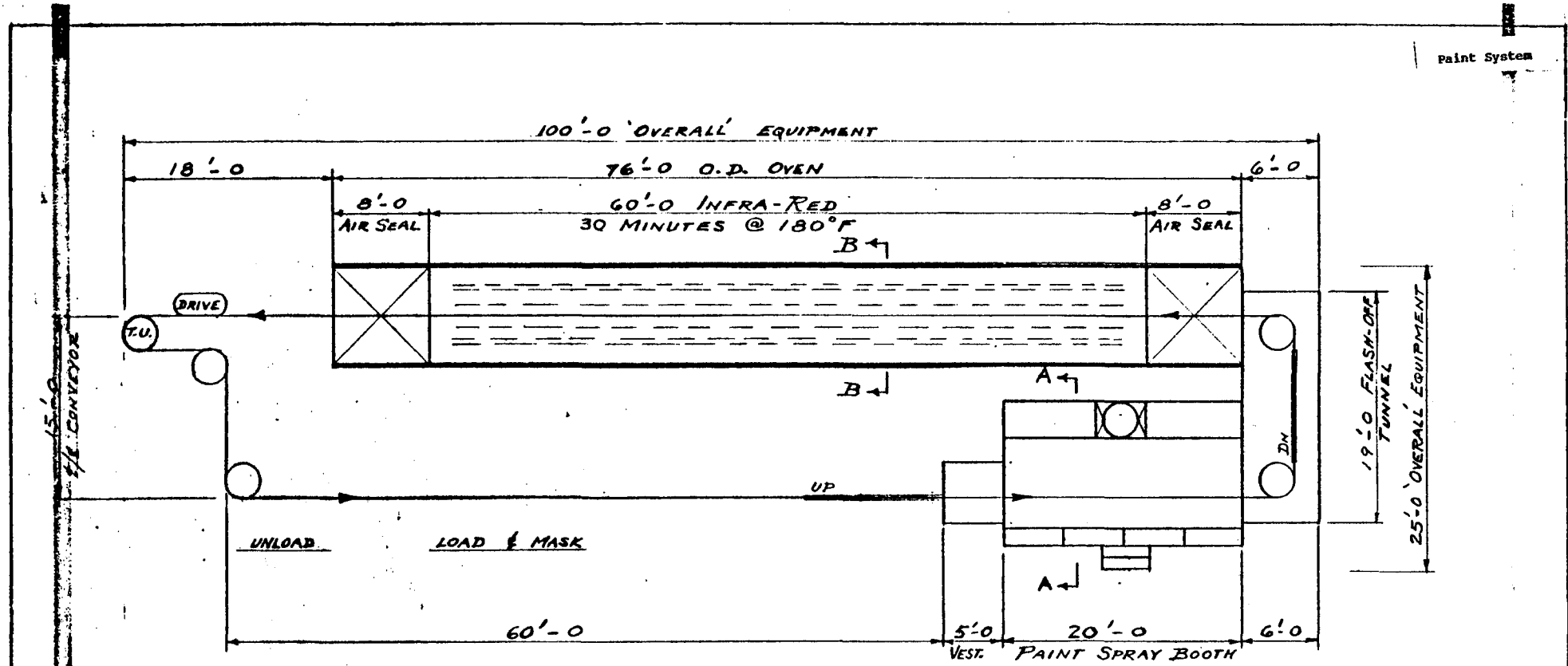
Miscellaneous

Estimated costs of cleaning solvents, cleaning rags, masking materials, etc. \$0.500/unit

Total paint material cost \$5.970/unit

Investment Cost

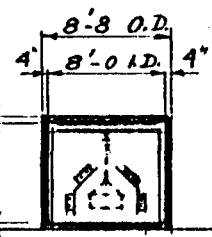
. Sidedraft spray booth, 20 ft. long with water wash and air make-up	\$135,000
. Enclosed infra-red bake oven 60 ft. long	100,000
. Overhead conveyer system - 210 ft.	85,000
. Paint pumps, spray guns, tanks, etc.	<u>10,000</u>
Total Investment	<u>\$330,000</u>



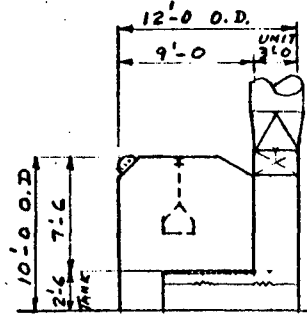
PLAN

NOTES

13 JPH - 2 - SHIFTS  
 WET ON WET - AIRLESS  
 CONVEYOR; 6" MONORAIL  
 PARTS ON 4" CTAS - 2 Pts/UNIT  
 CONV. SPEED - 4 - FPM



SECTION B-B



SECTION A-A

PART NO.		SHEET	SHEETS	DRAWING NO.
		1	1	PT 100
DES. BY	DEF. BY	TITLE		
G.W.		PAINT SYSTEM FOR		
CHKD BY	INVTY OK	HELIOSTAT DRIVE		
		ASSEMBLIES		
DATE	SCALE	DIVISION:		FORD MOTOR CO.
9-26-80	1/4" = 1'-0"	MANUFACTURING		
		PLANS DEPT.		

APPENDIX C

## Heliostat Manufacturing Study

OTHER BACK-UP DATA

- Machining Facilities and Load Charts C-2
  - Casting Machining (Sheets 1 thru 5)
  - Steel (Bar-Tube) Machining (Sheets 1 thru 3)
  - Summary of Plant Engineering Requirements (Sheets 1 - 2)
- Press Shop (Stamping & Forming Operations) C-12
  - Press Room Load Chart (Sheets 1 thru 3)
  - Press Shop, General - Plant Engineering Requirements
  - Press Shop Floor Layout
- Training, Preactivation and Launching Costs C-17
  - Manufacturing Plant:
    - Training & Preactivation Wages
    - Training Total Costs
    - Launching Wage Costs (Sheets 1&2)
  - Field Assembly Plant:
    - Training, Preactivation & Launching (Sheets 1 thru 3)

CASTING

MACHINING FACILITIES & LOAD SUMMARY

MAKE	MODEL	REF.	DATE:	LOCATION:	SUBJECT:
1	1	WINSMITH-AZIMUTH-D-6S1133-1B			
2	3	WORM GEAR HOUSING-79D234-1	13-3.75	30-1.25	13-3.75
	4				15-3.15
4	5	S.S. CAP 80024-3			30-1.67
	6				30-1.67
11	7	BASE 926610-23			30-1.60
	8				30-1.41
12	9	COVER 926720-20			30-1.60
	10				45-1.07
13	11	PLANET GEAR 936140-25			
	12				
14	13	PLANETARY FRAME 726310-26			
	14				
15	15	PRIMARY RING GEAR 736710-27			
	16				
16	17	SECONDARY RING GEAR 936910-28			
	18				
23	19	HOUSING 651140-22			
	20				
24	21	ATTACHMENT HOUSING 651140-96A			
	22				
26	23	H.S. CAP CLOSED 651140-78A			
	24				
27	25	S.S. COVER 651140-20			
	26				
29	27	MOTOR ADAPTOR C-7922-A			
	28				
44	29	GIMBAL HOUSING 531146			
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117107/BA 1301 (5/77)











STEEL - (BAR - TUBE)

MACHINING FACILITIES  
SUMMARY

STEEL MACHINING - SHEET-1 of 3

DATE: \_\_\_\_\_

LOCATION: \_\_\_\_\_

SUBJECT: \_\_\_\_\_

LINE NO.	PART NAME	PART NUMBER	MACHINING FACILITIES														
			POWER HACK SAW	TAPER LATHE	BORE	DRILL PRESS	MILL-MACH.	POWER HACK SAW	TRACED LATHE	GUN DRILL	SPEED LATHE	MILL	SPEED LATHE	GRIND	GRIND	POLISHER	ABRASIVE CUT OFF
1	WINSMITH AZIMUTH	D-651133-1B															
3	H. S. CAP	B00240-2	14-3.43	22-2.18	57-.84	51-.94	45-1.07										
6	S. S. SHAFT	B30234-A8-5		68-.71					42-1.14								
7	S. S. SHAFT SPACER SHORT	B35235-7							10-2.40	38-1.26	10-2.40	40-.80	30-1.60	40-1.20	40-1.20	25-1.92	34-1.41
9	S. S. SHAFT SPACER LONG	B35236-B							10-2.40	38-1.26	10-2.40	42-1.14	30-1.60	40-1.20	40-1.20		
10	H. S. HOUSING BUSHING	B35234-7															16-.50
19	FRICITION RING	926360-29	STAMPING														
19	JOURNAL PIN	926361-31															76-.63
21	BALL RETAINING BOLT	926913-37															16-.50
25	ATTACHMENT HSG. COVER	651140-DB3															
28	H. S. CAP	651140-18-6															
30	S. S. SHAFT (LEAD SCRW)	651140-23															
31	S. S. SPACER	651140-21-9															76-.50
32	S. S. SHAFT SPACER W/ASHER	651140-44															
38	UPPER STOP COLLER	651140-43															
39	LOWER STOP COLLER	651140-43															
64	RING ADAPTOR SWIVEL EXT	531442-8															
71	ADAPTOR EL. DR. TRIMMING	531442-01															
73	SLEEVE MOTOR REV. COUNTER	531442-01 REF.															73-1.00
77	ADJUSTER PC BOARD	EL-A2-531442-DB															
85	PIN - EL. BEARING	531442-16															
86	PIN - EL. ACT. MOUNT PIVOT	531442-17															







HELICOPTER SUMMARY  
50000 ANNUAL VOLUME

SHEET 2

MATL  
HBLG

PART NAME	CENTRAL ELECTRICAL SYSTEM	REFUEL SYSTEM	UPNT DISTRIB EQUIPMENT SYSTEM	CLUTCH SYSTEM	ENGINE COMPONENTS	TRANSMISSION COMPONENTS	ROTOR COMPONENTS	LANDING GEAR	HYDRAULIC SYSTEM	WHEEL AND BRAKES	AVIONICS EQUIPMENT	INTERIOR EQUIPMENT	EXTERIOR EQUIPMENT	STRUCTURAL COMPONENTS	PAINT	ASSEMBLY LABOR	TESTING LABOR	INSPECTION LABOR	PACKAGING LABOR	FLYING LABOR							
	93000				80000	5000	7700			2000	4000	4000	2000						10000	2800							
	62000						3500			1500	2000	2000	3000							1600							
	23000				40000	10000		12000		12000	3000	3000	5000						10000	3600							
	410000				80000	20000	2000			5000	3000	3000	8000						20000	7600							
	61000				40000	5000	5000			1000	3000	8000	8000						10000	3200							
	205000				40000	10000				23000	5000	8000							1000	4400							
	61000				20000	5000			13000	16000	3000	8000							1000	3200							
	240000				80000	20000	16000			53000	3000	10000	30000						10000	6000							
	112000				80000	5000	10200			2000	2000	12000							10000	4900							
	65000				80000	10000	4500			1000	4000	5000	2500						5000	2400							
	15000						3000			1000	2000	1000	1500						1000	500							
	12500						1000			500	1000	2000							2000	800							
	31000				10000	3000	1000			500	1000	3000	2000						2000	800							
	103000				40000	10000	9000			22000	5000	8000	7000	1000					10000	4000							
	6553000																			4500							
	77500				40000	5000	6500			2000	4000	7000	3000						2000	2800							
	186000				80000	10000				2200	4000	5000	4200						3000	5400							
																			13000								
																			8200								
										500	500		2500							1000							
	2000											500	2500							300							
	12500										1000	2000						21000	2000	7000							
	12500						1000					2000								1800							
	10000										1000	500						5500	300	300							
	10000				20000	3000				4000	1000		1000						500	300							
	10000				20000	2500				1000	1000	500	5500					1000	400	400							
	15500				40000	10000	10000			10000	5000	4000	3500	5000					2000	2000							
	20000				40000	10000	3000			1000	2000	7500							2000	1700							
	64000				20000	5000	4000			1000	2000	1000	2000						2000	1800							
	22000				40000	5000	3700			1500	3000	1500	9000						5000	1500							
										500	1000	1000								400							
	31000									1000	1000	1000	2000						1000	500							
																				1100							
					15000	27000				47000	15000	60000	13000						15000	45000							
																			30000	50000	31800						
Slow Speed Shaft (Lead Spr)	500000				80000	20000				15000	10000	10000	25000	4000					20000	24000							
	2506000				15000	27000				47000	15000	60000	13000						15000	45000							
					970000	173000	90600			106000	43000	268000	673000						135500	43000	1992000	12500			392000	113000	120000



HELIOSTAT MANUFACTURING STUDY  
PRESS ROOM LOAD CHART  
(IN HOURS BASED ON 30 DAY CYCLE)

DATE		LOCATION OR AFFILIATE																
NAME	NUMBER	80 TON SHEAR PRESS (1)	500 TON PRESS (2)	WELD FIXTURE (3)	FINE WIRE WELDR 2 REF (4)	ASSEMBLY FIXTURE WITH BORING HEAD (5)	125 TON O.B.I. PRESS (6)	BENCH DRILL PRESS 2 REF (7)	125 TON O.B.I. PRESS (8)	BENCH DRILL PRESS (9)	125 TON O.B.I. PRESS (10)	80 TON SHEAR PRESS (11)	BENCH DRILL PRESS (12)	80 TON SHEAR PRESS (13)	150 TON O.B.I. PRESS (14)	125 TON O.B.I. PRESS (15)	30 TON O.B.I. PRESS (16)	POWER M.S. 5 MIN 3 REPS (17)
ARM - ACTUATION	531147-1	62.4 HRS	74.03 HRS															
BRACE - CROSS	531147-2	62.4	24.96															
BRACE - CROSS	531147-3	62.4	24.96															
CHD FND	531147-4	62.4	24.96															
SUBASSEMBLY	531147			312 HRS	312 HRS													
SUBASSEMBLY	531147					312 HRS												
BRACKET ATTACHMENT PLATE	277-10119-18	14.76				368 HRS	384 HRS											
BRACKET ATTACHMENT PLATE	277-10119-14	2.4						99.84 HRS	208 HRS									
BRACKET ATTACHMENT PLATE	277-10119-17									199.68 HRS	24 HRS	416 HRS						
ATTACHMENT BRACKET	277-10119-15												192 HRS	374.4 HRS	374.4 HRS			
DOUBLER-BIU PLATE	277-10119-19												14.4			374.4 HRS		
STRUT	277-10120-5																69.3 HRS	
REINFORCEMENT ANGLE	277-10120-4													124.8			62.3	
REINFORCEMENT BAR	277-10120-3																416	
REINFORCEMENT ANGLE	277-10120-12																138.6	
BRACKET MAG. HOLDER	531442-15																	
ADAPTER MOTOR COUNTER	531442-2		10.4							52								
MOUNT ZERO REF	531442-13						156			104								121
MOUNT-PC BOARD	531442-06																	69
COVER - MOTOR REV. COUNTER	531442-03		45.7															69
ADAPTER MOTOR REV. COUNTER	531442-04		10.4															10
HOLDER ZERO REF.	531442-11																	10
FRICTION RING	926360																	
BRACKET RE CABLE WRAP	531442-24																	131
BRACKET MAG. HOLDER	531442-14						156											52
MOUNT ZERO REF.	531442-10				312													104
MAG. HOLDER REV. COUNTER	531442-09																	
FRICTION RING	926360										5							
TOTAL HOURS USED IN 30 DAYS		210.6	216.3	312	624	312	368	696	99.84	364	199.68	29	416	331.2	374.4	374.4	374.4	207.3
TOTAL HOURS AVAILABLE		480	480	480	960	480	480	960	480	480	480	480	480	480	480	480	480	1440
PERCENT UTILIZATION		43.9%	45.1%	65%	65%	65%	76.6%	72.5%	20.8%	75.8%	41.6%	6%	86.7%	69%	78%	78%	78%	63%

HELIOSTAT MANUFACTURING STUDY  
PRESS ROOM LOAD CHART  
(IN HOURS BASED ON 30 DAY CYCLE)

DATE	LOCATION OR AFFILIATE	HYDRO-PIERCE FIXTURE (1)	#3 MILLING MACHINE (2)	MULTI-HEAD DRILL PRESS (3)	MULTI-HEAD DRILL PRESS (4)	MULTI-HEAD DRILL PRESS (5)	ROTARY PRESS (6)	200 TON O.B.I. PRESS (7)	PROTH FINE WIRE WELDER Z-REF (8)	100 TON SHEAR PRESS (9)	BENCH GRINDER (10)	BRIDGE-PORT MILLING MACHINE Z-REF (11)	FACE LATHE (12)	#3 MILLING MACHINE (13)	BENCH DRILL PRESS Z-REF (14)	#3 MILLING MACHINE Z-REF (15)	BENCH DRILL PRESS (16)	TABLE GRINDER (17)			
1	ADJUSTMENT	53147-1																			
2	BORE CROSS	53147-2																			
3	BORE CROSS	53147-3																			
4	CAP END	53147-4																			
5	SUBASSEMBLY	53147																			
6	SUBASSEMBLY	53147																			
7	BRACKET ATTACHMENT PLATE	277-1011-13																			
8	BRACKET ATTACHMENT PLATE	277-1011-14																			
9	BRACKET ATTACHMENT PLATE	277-1011-17																			
10	ATTACHMENT BRACKET	277-1011-18																			
11	DOUBER B/U PLATE	277-1011-19																			
12	STRUT	277-10120-5	052 HRS																		
13	REINFORCEMENT ANGLE	277-10120-4																			
14	REINFORCEMENT BAR	277-10120-8		416 HRS	416 HRS	416 HRS	416 HRS														
15	REINFORCEMENT ANGLE	277-10120-12					199.7 HRS														
16	BRACKET MNG. HOLDER	531442-15						208 HRS	104 HRS		104 HRS										
17	ADAPTER MOTOR COUNTER	531442-2								10.4 HRS											
18	ADAPT REF. BOARD	531442-13							3/2			520 HRS	130 HRS								
19	ADAPT REF. BOARD	531442-02												52 HRS	416 HRS						
20	COVER MOTOR REV. COUNTER	531442-03							208	416		62.4			104						
21	ADAPTER MOTOR REV. COUNTER	531442-04								10.4		104			52						
22	HOLDER ZERO REF.	531442-11													104		312 HRS				
23	FRICTION RING	926360																	98.5 HRS		
24	BRACKET ACCESSORY WRAP	531442-29															312				
25	BRACKET MNG. HOLDER	531442-14											52	208				7.5 HRS			
26	ADAPT REF. BOARD	531442-10											76					249			
27	MNG. HOLDER REV. COUNTER	531442-09																26			
28	FRICTION RING	926360																			
29																					
30	TOTAL HOURS USED IN 30 DAYS	85.2	416	416	416	416	199.7	208	624	62.4	104	520	424.4	260	676	624	353	97.5			
31																					
32	TOTAL HOURS AVAILABLE	480	480	480	480	480	480	480	960	480	480	960	480	480	960	960	480	480			
33																					
34	PERCENT UTILIZATION	17.3%	86.7%	86.7%	86.7%	86.7%	41.6%	4.3%	65%	13%	21.7%	54.2%	88.4%	54.2%	70.4%	65%	73.5%	20.5%			
35																					
36																					
37																					
38																					
39																					
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42																					
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44																					
45																					
46																					
47																					
48																					
49																					
50																					

HELIOSTAT MANUFACTURING STUDY  
PRESS ROOM LOAD CHART  
(IN HOURS BASED ON 30 DAY CYCLE)

DATE		LOCATION OR AFFILIATE																
NAME	NUMBER	FACE LATHE (1)	MULTI HEAD DRILL PRESS 2-STEP (2)	CUT OFF SAW (3)	COILER WHEEL ROLLER (4)	COILER FUSION WELDER (5)	RING FINISHER (6)	MULTI-HEAD DRILL PRESS (7)	MULTI-HEAD DRILL PRESS (8)	15 FOOT TUBE EXPANDER (9)	INSPECTION FIXTURE (10)	INSPECTION FIXTURE (11)	INSPECTION FIXTURE (12)	INSPECTION FIXTURE Z-BFG (13)	SWISS ASSY FIXTURE (14)	WELDED FIXTURE (15)	INSPECTION FIXTURE Z-BFG (16)	(17)
ADAPTER RING	531439 A	104 HRS	312 HRS	104 HRS	104 HRS	104 HRS	104 HRS				104 HRS							
FLANGE INBOARD	SK 6130-002-4	104	312	104	104	104	104					104 HRS						
FLANGE OUTBOARD	SK 6130-002-3	104		104	104	104	104	312 HRS	312 HRS				104 HRS					
W. W. TUBE	SK 6130-002-2									312 HRS				624 HRS				
W. W. TUBE ASSEMBLY	SK 6130-002													104 HRS	104 HRS	624 HRS		
ADAPTER INBOARD BY COM	531442-02	26																
TOTAL HOURS USED IN 30 DAYS		348	624	312	312	312	312	312	312	312	104	104	104	624	104	104	624	
TOTAL HOURS AVAILABLE		480	960	480	480	480	480	480	480	480	480	480	480	960	480	480	480	
UTILIZATION		72.5 %	65 %	65 %	65 %	65 %	65 %	65 %	65 %	65 %	21.6 %	21.6 %	21.6 %	65 %	21.6 %	21.6 %	65 %	

R. HAEDWAY

PROCESS ESTIMATE SHEET

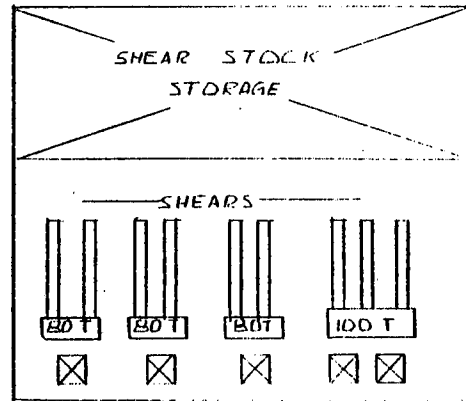
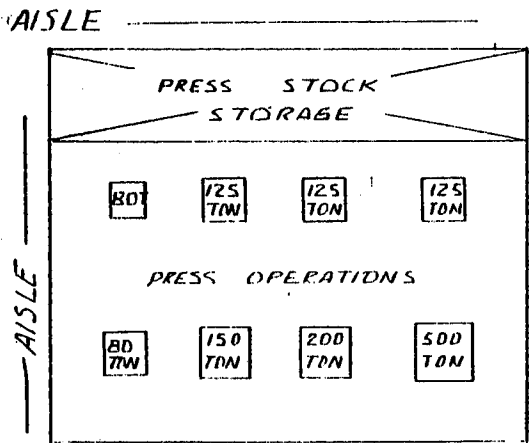
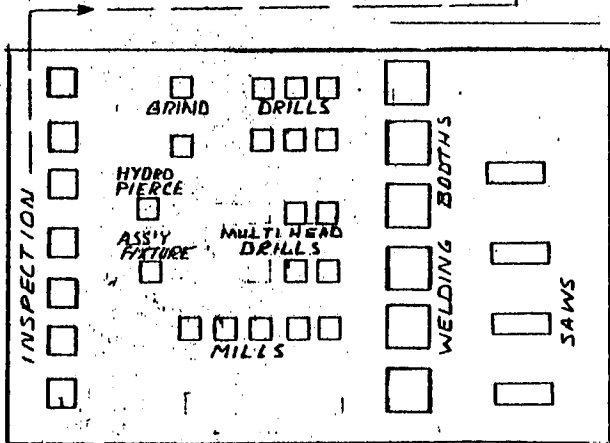
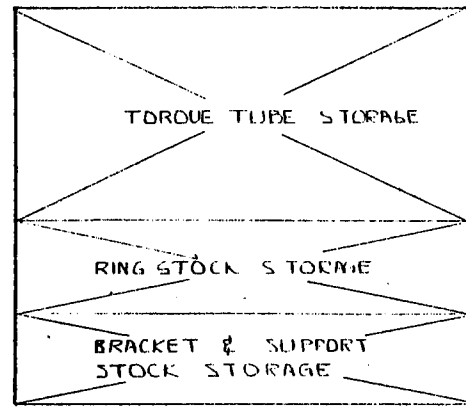
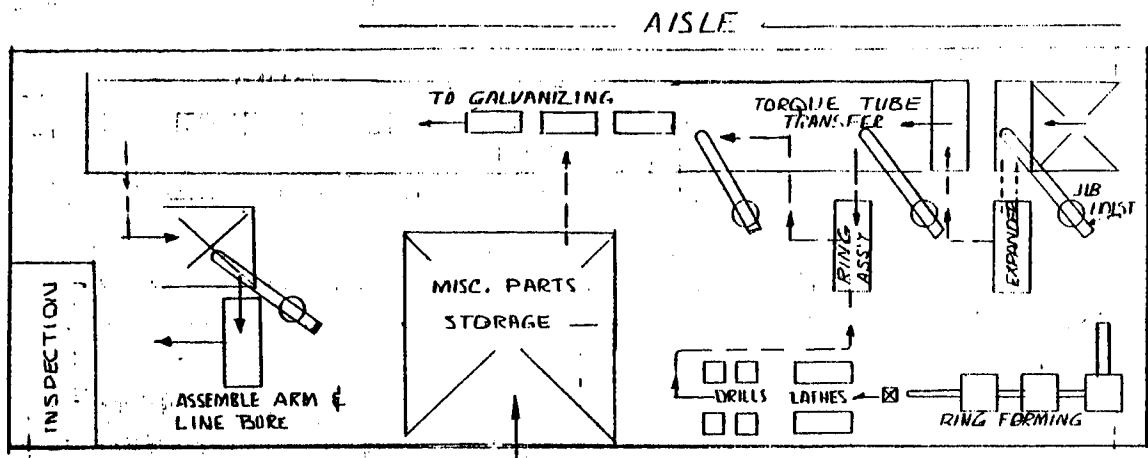
PROGRAM ECH NO.		PART NAME				ISSUE DATES		DEPARTMENT						
HELIOSTAT		PRESS SHOP - GENERAL				9-15-90		PART NO. ALL STAMPED PARTS						
FOR MODELS		MATERIAL PLANT ENGINEERING REQUIREMENTS				WT./LOS.		RGM.		FIN.				
										RELEASE SKIZZY 1-CP 1				
OPER. NO.	OPERATION DESCRIPTION	TOOL - MACHINE - EQUIPMENT DESCRIPTION - TOOL OR S.T. NUMBER	MACHS. RECD.	NET HOURLY CAP	EST. MINUTES	FACILITY AND DURABLE TOOL COST				SPECIAL TOOL COST				
						TOTAL	BASIC	FREIGHT	INSTALLATION	TOTAL	DESIGN	BUILD	INST. COST	
1	CHIP - COOLANT AND CLARIFICATION SYSTEMS													
2	COOLANT REFRIGERATION SYSTEM													
3	EXHAUST - FUMES - DUST AND VENTILATION	WELDING OPN.	6			75000	60000	3000	12000					
4	CO2 FIRE PROTECTION SYSTEM	WELDING OPN.	6			27000	15000	1000	6000					
5	MONORAIL CONVEYORS													
6	MONORAIL CARRIERS (TOOLING)													
7	ROLLER CONVEYOR													
8	POWERED CONVEYORS OF ALL		7			47000	36000	2000	9000					
9	PLATFORMS - STILES					15000	10000		5000					
10	SERVICE RAILS AND HOISTS	JIB HOISTS (1)TON	4			60000	50000	2000	28000					
11	TOOL CABINETS - RACKS AND STANDS	DIE TABLES				13000	10000	500	2500					
12	TOOL CONTROL BOARDS													
13	WORK - GAGING AND INSPECTION TABLES					15000	7500		7500					
14	PAPER BASKETS (EXPENSE)													
15	PRODUCTION AIDS - ASSEMBLY AIDS					15000	10000		5000					
16	SECONDARY LIGHTING													
17	PROGRAMMABLE CONTROLLERS													
18	AUTOMATION - PART HANDLING SYSTEM	TUBE & LINE HANDLING				300000	250000		50000					
19	ENGINEERING SERVICES DESIGN - (EXPENSE)													50000
20	BUILDING SERVICES - UTILITIES													
21	POWER AND FREE CONVEYOR SYSTEM													
22	POWER AND FREE CONVEYOR CARRIERS (TOOLING)													
23	MACHINE FOUNDATIONS AND DECKS													
24	PLANT REARRANGEMENT (EXPENSE)													
25	MATERIALS HANDLING - RACKS - CONTAINERS - DORAGE					30000	25000		5000					
BUILDING CONSTRUCTION		34,800 SQ.FT.				507000	453500	8500	130000					
TOTALS														

REMARKS: BUILDING CRANE REQUIRED FOR STEEL HANDLING

PROCESS ENGR.	PLT. LAYOUT	AUTOMATION	DESIGN	MATL. HDLG. ENGR.	DAILY SERVICE	VEH. PER VEHICLE	HEAT ASST.	QUAL. CONTR.	PLT. ENGR.	INSTR.	DAILY PLT. PLANNING	INSTR.	STAMPING

SHIPPING

RECEIVING



AREA = 40,000 SQ. FT.

PRESS SHOP  
STAMPING AND FORMING  
OPERATIONS

TRAINING, PREACTIVATION AND LAUNCHING COSTSSummary \$(000)

	<u>Manufacturing Plant</u>		<u>Field Assembly Plant</u>	
	<u>1st Shift</u>	<u>2nd Shift</u>	<u>1st Shift</u>	<u>2nd Shift</u>
<u>Training Total Costs</u>				
Direct Labor	\$350	\$350	Total	\$32
Indirect Labor	886	612	Total	36
Salary	883	308	Total	55
<u>Preactivation Wage Costs</u>				
Direct Labor	255	183	\$26	\$11
Indirect Labor	437	171	12	5
Salary	828	113	8	5
<u>Launching Wage Costs</u>				
Direct Labor	1,416	469	39	22
Indirect Labor	1,652	374	19	10

HELIOSTAT MANUFACTURING STUDY

TRAINING & PREACTIVATION - MANUFACTURING PLANT

WAGE COST

			AVG. MAN WEEKS ON ROLL BEFORE JOB 1	NO. OF MEN	TOTAL MAN WEEKS BEFORE JOB 1	ALLOCATION OF TRAINING			ALLOCATION OF PREACTIVATION		
						%	MAN WEEKS	\$(000)	%	MAN WEEKS	\$(000)
<u>FIRST SHIFT</u>											
DIRECT LABOR	UNSKILLED		8	130	1040	50%	520	\$156.0	50%	520	\$156.0
	SEMI SKILLED	AVG. \$7.50/HR	15	55	825	60%	495	148.5	40%	330	99.0
TOTAL DIRECT LABOR				185	1865		1015	\$304.5		850	\$255.0
INDIRECT HOURLY	UNSKILLED		9	57	513	50%	257	\$ 77.1	50%	256	\$ 76.8
	SEMI SKILLED	AVG. \$7.50/HR	15	91	1365	60%	819	245.7	40%	546	163.8
	SKILLED	\$10.00/HR	32	51	1632	70%	1142	456.8	30%	490	196.0
TOTAL INDIRECT HOURLY				199	3510		2218	\$779.6		1292	\$436.6
SALARY	(OVERALL AVERAGE) \$2000/MO.		26	137	3562	50%	1781	\$828.2	50%	1781	\$828.2
<u>SECOND SHIFT</u>											
DIRECT LABOR	UNSKILLED		7	130	910	57%	520	\$156.0	43%	390	\$117.0
	SEMI SKILLED		13	55	715	69%	495	148.5	31%	220	66.0
TOTAL DIRECT LABOR				185	1625		1015	\$304.5		610	\$183.0
INDIRECT HOURLY	UNSKILLED		8	28	224	57%	128	\$ 38.4	43%	96	\$ 28.8
	SEMI SKILLED		13	74	962	69%	664	199.2	31%	298	89.4
	SKILLED		26	34	884	85%	751	300.4	15%	133	53.2
TOTAL INDIRECT HOURLY				136	2070		1543	\$538.0		527	\$171.4
SALARY			18	48	864	72%	622	\$289.2	28%	242	\$112.5

HELIOSTAT MANUFACTURING STUDY

TRAINING - MANUFACTURING PLANT

		DIRECT LABOR			INDIRECT HOURLY				SALARY
		UN- SKILLED	SEMI SKILLED	TOTAL	UN- SKILLED	SEMI SKILLED	SKILLED	TOTAL	
COST ITEMS	TOOLS AND EQUIPMENT	\$ 50	\$125	-	\$ 50	\$125	\$ 350	-	(OVERALL AVERAGE)
OTHER THAN	MATERIALS AND SUPPLIES	100	200	-	100	200	700	-	
WAGES PER	TRAINING COURSE DEVELOPMENT, TEXTS, AIDS, INSTRUCTOR FEES	40	50	-	40	50	150	-	
EMPLOYEE	TOTAL	\$190	\$375	-	\$190	\$375	\$1200	-	
<u>FIRST SHIFT</u>	NO. OF EMPLOYEES	130	55	185	57	91	51	199	137
	SUB TOTAL MAT'L COST (\$000)	\$ 24.7	\$ 20.6	\$ 45.3	\$ 10.8	\$ 34.1	\$ 61.2	\$106.1	\$ 54.8
	SUB TOTAL WAGE COST (\$000)	<u>156.0</u>	<u>148.5</u>	<u>304.5</u>	<u>77.1</u>	<u>245.7</u>	<u>456.8</u>	<u>779.6</u>	<u>828.2</u>
	TOTAL TRAINING COST (\$000)			\$349.8	\$ 87.9	\$279.8	\$ 518.0	\$885.7	\$883.0
<u>SECOND SHIFT</u>	NO. OF EMPLOYEES	130	55	185	28	74	34	136	48
	SUB TOTAL MAT'L COST (\$000)	\$ 24.7	\$ 20.6	\$ 45.3	\$ 5.3	\$ 27.8	\$ 40.8	\$ 73.9	\$ 19.2
	SUB TOTAL WAGE COST (\$000)	<u>156.0</u>	<u>148.5</u>	<u>304.5</u>	<u>38.4</u>	<u>199.2</u>	<u>300.4</u>	<u>538.0</u>	<u>289.2</u>
	TOTAL TRAINING COST (\$000)			\$349.8	\$ 43.7	\$227.0	\$ 341.2	\$611.9	\$308.4



## HELIOSTAT MANUFACTURING STUDY

LAUNCHING WAGE COSTSMANUFACTURING PLANTFIRST SHIFT

From Job 1 to Full Production Rate - 29 weeks  
Planned Output at 22% of Full Rate

Direct Labor

185 men x 29 weeks x 40 hours	214,600 man hours
Less Authorization at 22% of Full Rate	(47,212)
Plus Overtime at 10% During Launch	<u>21,460</u>

Net Direct Labor Hours attributable to Launch	188,848
--	---------

Direct Labor Launch Cost at \$7.50/hr	\$1,416,360
---------------------------------------	-------------

Indirect Hourly

199 men x 29 weeks x 40 hours	230,840 man hours
Less Authorization at 22% of Full Rate	(50,785)
Plus Overtime at 10% During Launch	<u>23,084</u>

Net Indirect Hourly Hours attributable to Launch	203,139
---	---------

Indirect Labor Launch Cost at \$8.13/hr	1,651,520
---	-----------

SECOND SHIFT

From Job 1 to Full Production Rate -  
13 Weeks at 40% of Full Rate

Direct Labor

185 men x 13 weeks x 40 hours	96,200 man hours
Less Authorization at 40% of Full Rate	(38,480)
Plus Overtime at 5% During Launch	<u>4,810</u>

Net Direct Labor Hours attributable to Launch	62,530
--	--------

Direct Labor Launch Cost at \$7.50/hr.	468,975
--	---------

(Con't)

Indirect Hourly

136 men x 13 weeks x 40 hours	70,720 man hours	
Less Authorization at 40 % of Full Rate	(28,288)	
Plus Overtime at 5% During Launch	<u>3,536</u>	
Net Indirect Hourly Hours attributable to Launch	45,968	
Indirect Labor Launch Cost at \$8.13/hr		\$ 373,720

## HELIOSTAT MANUFACTURING STUDY

FINAL FIELD ASSEMBLY PLANT

Because of the significant difference in manufacturing complexity of the Field Assembly operation compared to the Manufacturing Plant, training, preactivation and launching costs are considerably less in terms of cost per operator for the Field Assembly and Installation portion of this study:

TRAININGDirect Labor

Wage cost at 40 hrs/man x \$7.50/hr x 79 men	\$23,700
Training materials, tools, fees at \$100/man	<u>7,900</u>
	<u>\$31,600</u>

Indirect Hourly

## UNSKILLED AND SEMISKILLED:

Wage cost at 40 hrs/man x \$7.50/hr x 36 men	\$10,800
Training materials, tools, fees at \$100/man	<u>3,600</u>

## SKILLED:

Wage cost at 500 hrs/man x \$10/hr x 4 men	20,000
Training materials, tools, fees at \$500/man	<u>2,000</u>
	<u>\$36,400</u>

Salary

Average wage cost of \$2000/month x 2 months x 13 men	\$52,000
Training materials, fees, etc. at \$200/man	<u>2,600</u>
	<u>\$54,600</u>

PREACTIVATIONFIRST SHIFT

Allow a two week preactivation period for all people following completion of training period:

Direct Labor

43 men x 80 hrs/man x \$7.50/hr	<u>\$25,800</u>
---------------------------------	-----------------

(Con't)

Indirect Hourly

## UNSKILLED AND SEMISKILLED:

18 men x 80 hrs/man x \$7.50/hr	\$10,800
---------------------------------	----------

## SKILLED:

2 men x 80 hrs/man x \$10/hr	<u>1,600</u>
------------------------------	--------------

	<u>\$12,400</u>
--	-----------------

Salary

8 men x 1/2 month x \$2,000/month	<u>\$ 8,000</u>
-----------------------------------	-----------------

SECOND SHIFT

Allow one week preactivation for Second Shift

Direct Labor

36 men x 40 hrs/man x \$7.50/hr	<u>\$10,800</u>
---------------------------------	-----------------

Indirect Hourly

## UNSKILLED AND SEMISKILLED:

14 men x 40 hrs/man x \$7.50/hr	\$ 4,200
---------------------------------	----------

## SKILLED:

2 men x 40 hrs/man x \$10/hr	<u>800</u>
------------------------------	------------

	<u>\$ 5,000</u>
--	-----------------

Salary

5 men x 1/2 month x \$2000/month	<u>\$ 5,000</u>
----------------------------------	-----------------

LAUNCHINGFIRST SHIFT

Base acceleration period is 6 weeks from zero to full production rate of 8 UPH (Units Per Hour).

Net production during launch period: 50% of full on average for 6 week acceleration.

Direct Labor

43 men x 40 hrs/week x 6 weeks x \$7.50/hr x 50%	<u>\$38,700</u>
--	-----------------

Indirect Labor

## UNSKILLED AND SEMISKILLED:

18 men x 40 hrs/week x 6 weeks x \$7.50/hr x 50%	\$16,200
--	----------

## SKILLED:

2 men x 40 hrs/week x 6 weeks x \$10/hr x 50%	<u>2,400</u>
---	--------------

	<u>\$18,600</u>
--	-----------------

SECOND SHIFT (Base acceleration period of 4 weeks)Direct Labor

36 men x 40 hrs/week x 4 weeks x \$7.50/hr x 50%	<u>\$21,600</u>
--	-----------------

Indirect Hourly

## UNSKILLED AND SEMISKILLED:

14 men x 40 hrs/week x 4 weeks x \$7.50 x 50%	\$ 8,400
---	----------

## SKILLED:

2 men x 40 hrs/week x 4 weeks x \$10/hr x 50%	<u>1,600</u>
---	--------------

	<u>\$10,000</u>
--	-----------------

**Appendix J**

**Detailed Cost and Process Description Data**

**for the**

**Heliostat Facet Assembly**

**Prepared by**

**Pittsburgh Corning Corporation  
Port Allegany, Pennsylvania**

Appendix J  
Detailed Cost and Process Description Data  
for the  
Heliostat Facet Assembly

J.1 General

This appendix was prepared by the Pittsburgh Corning Corporation under a subcontract with Boeing Engineering and Construction Company. The detailed data in this appendix was partly used to develop the production cost estimates shown in Appendix G.

J.2 Use of Information in this Appendix

Data provided in this appendix is published to provide a record of detailed work accomplished by Pittsburgh Corning Corporation. The user is cautioned that data must be used selectively because of subsequent changes in production plans and design, errors in tabulation, and a reduction in the cost of glass. Specific examples of these changes include:

1. The manufacturing concept developed by Pittsburgh Corning was based on a "stand-alone" facet assembly plant. When this plant is integrated with the gimbal and frame manufacturing plant, certain scale economies result (slight reduction in administrative personnel, improved supply logistics, etc.). These economies are reflected in the cost estimates developed in Appendix G. In addition, a slightly different shipping crate, block time analysis and configuration resulted in lowered facet shipping costs.
2. Pittsburgh Corning developed cost estimates based on a facet size of x 11 feet. The final production design is 4 x 10 feet.
3. The cost of fusion glass was assumed to be \$0.75/ft<sup>2</sup>. Final production costs used \$0.344/ft<sup>2</sup> based on a Corning Glass Works letter of 11/13/79 (assuming continuous production in a dedicated plant).
4. Hourly employee labor costs were erroneously understated by a factor of two. This error was corrected in finalized cost estimates.

Boeing Second Generation Heliostat Program

Final Report  
&  
Production Plan

PITTSBURGH CORNING CORPORATION

R. Y. Greene  
Sr. Development Engineer



Final Report to BEC

1. Task I

The responsibilities of Pittsburgh Corning Corporation to the Boeing Second Generation Heliostat Program include:

- 1.1 Provide detail design support and materials recommendations for the proposed heliostat reflector panels.
- 1.2 Using the design in 1.1 above, provide a manufacturing plan including credible capital estimates, life cycle costs and special tooling necessary to achieve economical production and identify any features of the detail design that could be altered to achieve more economical production.
- 1.3 Develop, using the detailed design and manufacturing plan in 1.1 and 1.2 above, projected capital cost estimates for: 1) a production facility capable of providing glass reflector panels for up to 50,000 heliostats per year; and 2) reflector panel costs as a function of production rate. Cost estimates are to be in April 1980 dollars.

2. Task II

To fabricate 32 prototype facets and employ any information learned therein to revise the cost estimates made in Task I. This work entails manufacture of special tooling needed in production of the prototype units.

3. Manufacturing Plan

3.1 The scope of the manufacturing plan is to describe in general the procedure and materials involved in the manufacture of heliostat facets.

3.1.1 The plan involves a plant dedicated to the production of FOAMSIL<sup>R</sup>-75 ware for consumption solely by the facet plant.

3.1.2 The facet plant entails the mating of one silvered lite of glass, one clear lite of glass and a core of FOAMSIL-75 blocks into a reflector panel capable of withstanding 90 mph winds and a 30-year outdoor life cycle.

3.2 Component Materials - Make/Buy Decisions

Amounts necessary for 50,000 heliostat units per year.

3.2.1 Fusion Glass, Clear                      48" x 132" x 0.060"                      27.8MM ft<sup>2</sup>

Buy - Technology is property of Corning Glass Works. To supply the quantities in question, Corning Glass Works would expand its facilities in Blacksburg, Virginia rather than establish a plant in the Southwest.

3.2.2 Fusion Glass, Silvered                      48" x 132" x 0.060"                      27.8MM ft<sup>2</sup>

Buy - As in 3.2.1, the fusion glass would be purchased from Corning Glass

Works and silvered on an in-line silvering facility at Blacksburg. Silvering in-line with the glass making process will provide the best reflective surface due to the lack of contamination available to the surface to be silvered.

3.2.3 FOAMSIL<sup>R</sup>-75 Ware 19" x 24-1/4" x 2" 55.6MM bd ft

Make - Plant to be situated adjacent to the facet assembly plant with "through the wall" delivery. All materials involved in the production of FOAMSIL-75 ware are to be purchased.

3.2.4 Epoxy Adhesive (2-component) 2.96MM lbs

Buy - Well established large plant operations in a number of locations by several companies are capable of supplying this quantity of material (Shell, Dow, Henkel, Ciba-Geigy, Devcon).

3.2.5 Hot Melt Butyl Sealant 84M gal

Buy - Commercially available in this quantity from several companies-- including the Norton Company and H. B. Fuller Company.

3.2.6 Cap Strip Adhesive 355M gal

Buy - Urethane modified asphalt is available from Pittsburgh Corning Corporation, Flintkote, and others.

3.2.7 Cap Strips 18.9MM ft

Buy - Available locally from sheetmetal shops. Business could be farmed out to a large number of contractors. Purchase primed and painted.

3.2.8 Corner Caps 2.5MM pieces

Buy - To be manufactured on punch press equipment. Available locally from large stamping companies. Purchase primed and painted.

3.2.9 Paint - Backsheets 55M gal

Buy - Photocurable 100% solids urethane. Available from several sources, i.e., Hughson Chemicals, Dupont, Ameron, Mobay. Application is 1 mil of white and 2 mils of clear.

All materials are to be shipped to the plant in the Pheonix, Arizona area via rail or truck. All glass will be shipped via open top truck. Adhesives are to be received from rail tank cars. The paint and hot melt butyl may be shipped either by rail or truck and the cap strips and corner caps should arrive by truck.

All make/buy decisions and shipping requirements are not affected by the production rate, be it 25M, 50M or 67.5M heliostat units per year.

### 3.3 Plant Process and Equipment

This section contains a description of the plant and processing equipment necessary to manufacture facets for 50,000 heliostats per year each containing 12 facets.

#### 3.3.1 Facet Assembly

The facet is composed of a fusion glass, FOAMSIL<sup>R</sup>-75 core, fusion glass sandwich with one sheet of the fusion glass being silvered and painted.

##### 3.3.1.1 FOAMSIL-75 Core Material Manufacture (Fig. 3-1,1A)

This section provides an overview of the general FOAMSIL-75 ware manufacturing process.

- (1) Materials are received and stored either in silos or in their shipping containers ready for use in the mixing area.
- (2) Materials are automatically fed into continuous ball mills which deliver "ground batch" to a storage silo.
- (3) Ground batch is automatically fed onto a belt which carries it through a sintering furnace where volatile materials are removed to form a "klinker."
- (4) The klinker is ground and sized (and reground if necessary) and fed into a final batch storage silo.
- (5) Stainless steel mold pans are filled with the final batch and automatically fed into a cellulating furnace where the foaming operation takes place.
- (6) When the pans emerge from the cellulating furnaces, the molds are stripped and the "buns" placed in the annealing Lehr where they are cooled under controlled conditions to room temperature.
- (7) After annealing, the buns are trimmed on all six sides to 19" x 24-1/4" x 2" thick, palletized on special pallets and either warehoused or sent via conveyor to the facet plant.
- (8) Quality assurance will be by density, modulus, water vapor permeability and visual appearance checks done on a statistically realistic basis.

##### 3.3.1.2 Facet Assembly

This section details the manufacture of the facet assembly. There are three separate operations which must take place (reflective surface preparation, core preparation and backsheet preparation) before the facet can be assembled. See Fig. 3-2,2-A,3.

### 3.3.1.2.1 Reflective Surface Preparation

The silvered fusion glass lites are received on A-frame shipping frames each weighing 5 tons and holding approximately 270 lites each. These frames are handled using overhead cranes and a wire guided, rubber tired, computer controlled, transport system which is designed so that all materials may be moved using the same system.

- (1) The shipping frames are unloaded automatically using the unloader described in 3.3.1.3(1) and placed on a conveyor paint side up.
- (2) The mirror is advanced through a scrubber which scrubs both sides, rinses with deionized water and dries with a blast of warm air.
- (3) The mirror is turned over using a device much like the unloader and the backsheet/facet transfer device (Fig. 3-4).
- (4) The mirror is inspected for mechanical integrity and rejected if necessary.
- (5) The mirror is again turned over so as to be paint side up.
- (6) A two-component epoxy adhesive of short (~10 min) cure time is spray applied to the painted side.
- (7) The mirror with adhesive is conveyed to the mirror transfer and then onto the building table where it is indexed in place using EAR switches and ultrasonic sensing devices (Fig. 3-5).

### 3.3.1.2.2 Core Block Preparation

- (1) The FOAMSIL<sup>R</sup>-75 core blocks are transported as received from the FOAMSIL-75 plant to the unloading stations where they are placed on the conveyor.
- (2) The blocks progress through a roll sander, flipover and another roll sander so as to sand both sides and bring the block within dimensional tolerances.
- (3) The blocks move through a saw station which saws every 14th block in half so as to make it 9-1/2" x 24-1/4".
- (4) They now proceed through an adhesive application station where a stripe of fast curing two-component adhesive is applied to two edges. See Fig. 3-6.
- (5) The blocks with adhesive now travel to the crossover conveyor (one for each pre-assembly table). One half of the blocks are turned 180 degrees so that the 19" direction adhesive lines of both sides are facing each other.
- (6) They are placed on the ratcheting pre-assembly table using the vacuum operated placement device (Fig. 3-7,7A).

- (7) The core block placement/indexing device (Fig. 3-8) now is lowered over the table with the indexing pins providing positive placement.
- (8) The compression bars are used to push the blocks together then the vacuum cups are used to hold each block in place.
- (9) The device then moves to one of four selected tables and places the block core on the adhesive coated side of the mirror using the same index pin/hole setup used on the pre-assembly table.
- (10) The compression bars and vacuum cups release and the transfer device moves back to its store position.

#### 3.3.1.2.3 Backsheet Preparation

- (1) The backsheets arrive in the plant in a manner identical to that in which the mirrors are received. They are loaded onto conveyors and unstacked the same way.
- (2) The backsheet is scrubbed on both sides, rinsed with deionized water and dried with warm air.
- (3) It next passes through a roller coating device which delivers 1 mil of photocurable white pigmented urethane coating which is cured by a series of lamps.
- (4) A second roller coater applies 2 mils of a clear photocurable urethane coating which is cured by lamps on the conveyor line.
- (5) The painted back lite is now turned over using a device identical to those in use on the mirror line.
- (6) It runs through an identical adhesive application station and subsequent quality control and on to the distribution conveyor.
- (7) The distribution conveyor stops at the appointed location and the backsheet/facet transfer device (Fig. 3-9) picks the backsheet off the conveyor and indexes it on the core blocks--adhesive down.
- (8) The transfer device then returns to its stow position under the backsheet/facet conveyor.

#### 3.3.1.2.4 Curing and Finishing

- (1) The vacuum cover moves over the assembled facet, vacuum is applied and the facet is allowed to cure for several minutes.
- (2) The vacuum cover is removed and the facet is transferred to the backsheet/facet conveyor using the same transfer/placement device used to put the backsheet in place.

- (3) The facet travels to a flipover very similar to those used to turn the glass sheets over.
- (4) The facet now pauses in the optical inspection station where the optical properties are determined and substandard facets are rejected.
- (5) After scrutiny, the facet moves to a station where padded pins raise the facet and a padded pallet several inches smaller than the facet is moved under it. The pins lower the facet onto the pallet. The pallet is necessary to allow space between the conveyor and the facet for application of the butyl sealant and for the cap strips.
- (6) The facet now moves into the hot melt butyl applicator section. First, beads are applied along two edges, the panel stops, changes direction by 90 degrees and sealant is applied to the other two edges. See Fig. 3-10.
- (7) The next two stations are where cap strips and corner caps are installed. See Fig. 3-11. The facet moves into the first station where the cap strips are pressed into place automatically using the devices indicated. The second station installs the corner clips.
- (8) The completed facet now moves through an inspection station which makes use of electronics to spot defects related to the cap strips on the underside.
- (9)
  - a. If defects are located, the facet moves to a repair area for repairing or rejection. If repairable, the repairs are made and the facet is returned to the stream.
  - b. If no defects are found, the facets move into a surge area capable of holding about 18 minutes production which gives the cap strip adhesive ample time to cure.
- (10) At the end of the accumulator a flipover device, identical to those used as backsheet/facet transfer devices, removes the facet from its pallet and places it at a crating station.
  - a. The pallet is rotated 90 degrees and placed on a pallet return conveyor where it returns to point 5 of this section.
- (11) The crates (Fig. 3-11) arrives at the crating station on rails. Only half of the crate is present and it is tilted back about 5 degrees.
- (12) A device, virtually identical to a glass crate unloader, places the facet in the crate. There are 12 facets per crate.
- (13) The crate is transported to the facet storage area where the upper half is assembled to it and either shipped via truck or stored.

3.3.1.3 This section covers the specialized equipment necessary for facet production in the volumes specified.

- (1) Glass/Mirror Unstacker consists of a central swivel point with five arms carrying two vacuum pads each. It fastens itself to the sheet, moves it up, out and over, then passes through the rolls of the conveyor simultaneously releasing the vacuum and allowing the sheet to be held off the vacuum pads by the conveyor rolls.
- (2) Glass and Facet Turnovers are very much like the Glass/Mirror Unstackers. The only difference is that they swivel 180 degrees and do not need to move up and down. See Fig. 3-4.
- (3) The Block Placement Device consists of two sets of vacuum operated lift/transfers (Fig. 3-7A) which picks up individual blocks of FOAMSIL<sup>R</sup>-75 ware and places them on the ratcheting pre-assembly table (Fig. 3-7). The blocks are delivered via belt conveyors with sensors which properly position the blocks for pickup.
- (4) The Core Block Transfer Device (Fig 3-8) performs the double duty of pushing the blocks together (they are originally placed about 1/2" apart) and transporting them from the pre-assembly table on to the building table. The compression bars are operated using air cylinders then the vacuum pads are lowered via the electric solenoids and the core is transported en masse.
- (5) The Building Table is the central position of the entire process (Fig. 3-5). It consists of a fine-finish steel tooling plate mounted on a fully adjustable table. It contains devices which index the reflective sheet, and help hold the core blocks in place while under vacuum. The building table is also equipped with holes across its surface for use either as air float or vacuum holding of the mirror. Attached to the building table is a vacuum cover that swings into position when the facet is assembled and ready for curing.
- (6) The Backsheet/Facet Transfer Device (Fig. 3-9) is very similar to the turnovers described in Item 2 above with the exception that the flipover portion has two sets of vacuum pads--one on either side of the arms--and it is mounted on a carriage which moves from between two building tables to an area under the backsheet/facet conveyor--which is its normal stow position. Its function is to pick up the painted, adhesive coated backsheet and place it on the core with the adhesive side down then when the facet is cured, to remove it to the conveyor using the exact reverse of the same process. One transfer device serves two building tables. Index control is by EAR switches and ultrasonic proximity sensors.
- (7) The Hot Melt Butyl Application Station (Fig. 3-10) consists of two sets of four hot melt bead extrusion tips mounted so that the facet passes through one set getting four beads applied in one direction, changes direction 90 degrees then has four beads applied in the other direction.
- (8) The Cap Strip Application Section (Fig. 3-11) functions as described

below.

The edge strips are packaged as a "clip" and are fed one at a time down onto a roller conveyor (with centering rolls) with the open side up. When a facet is in position, the four edge strips are passed under extrusion heads where they are filled with the cap strip adhesive (two-part Urethane-Asphalt). They continue into a full length holder which has a full length lip that engages the edge of the cap strip and flexes it "open". This provides for clearance of the glass and butyl sealant when the air cylinder presses the edge strip onto the facet. The lip then retracts and releases the edge strip. The air cylinder provides the force to seat the strip onto the facet and to force the adhesive to flow into any voids.

The corner clips are installed in a similar manner. The clips will be fed from bins using standard type parts feeders. They will be placed into a holder, filled with adhesive, then applied to the facet at the second station.

- (9) The Facet Shipping Crate (Fig. 3-11) is of 1/8" tempered aluminum sheet and is made of two mirror image parts so that it may be broken down for easy shipment and storage. The fasteners are slide bolts and pins with locking devices. The interior pads are semiflexible 26 pcf self-skinning urethane foam and are easily replaced if damaged.

3.3.1.4 Some of the equipment necessary to operate the plant which is currently available is listed below under two categories.

#### 1. General and Handling

##### Overhead Bridge Cranes

Wire guided, rubber tired, computer controlled Transport System  
Above and below ground Storage Tanks and Pumps (equipped with line heaters and insulation)

Dust Collection and general Air Handling Equipment

Air Conditioning and Heat for Offices, Maintenance, and Facet  
Assembly Areas - warehousing is uncontrolled

Rail Car Unloading Stations - both piping and towmotor handling  
Truck Loading and Unloading Docks

Fully equipped Machine Shop with lathes, milling machines and  
surface grinders and welding equipment.

Glass Handling A-Frames for shipping

#### 2. Facet Assembly and Quality Control

Glass Unstackers

Glass "donut" Conveyors

Standard Belt Conveyors

Planeing Machines for sanding FOAMSIL<sup>R</sup>-75 ware

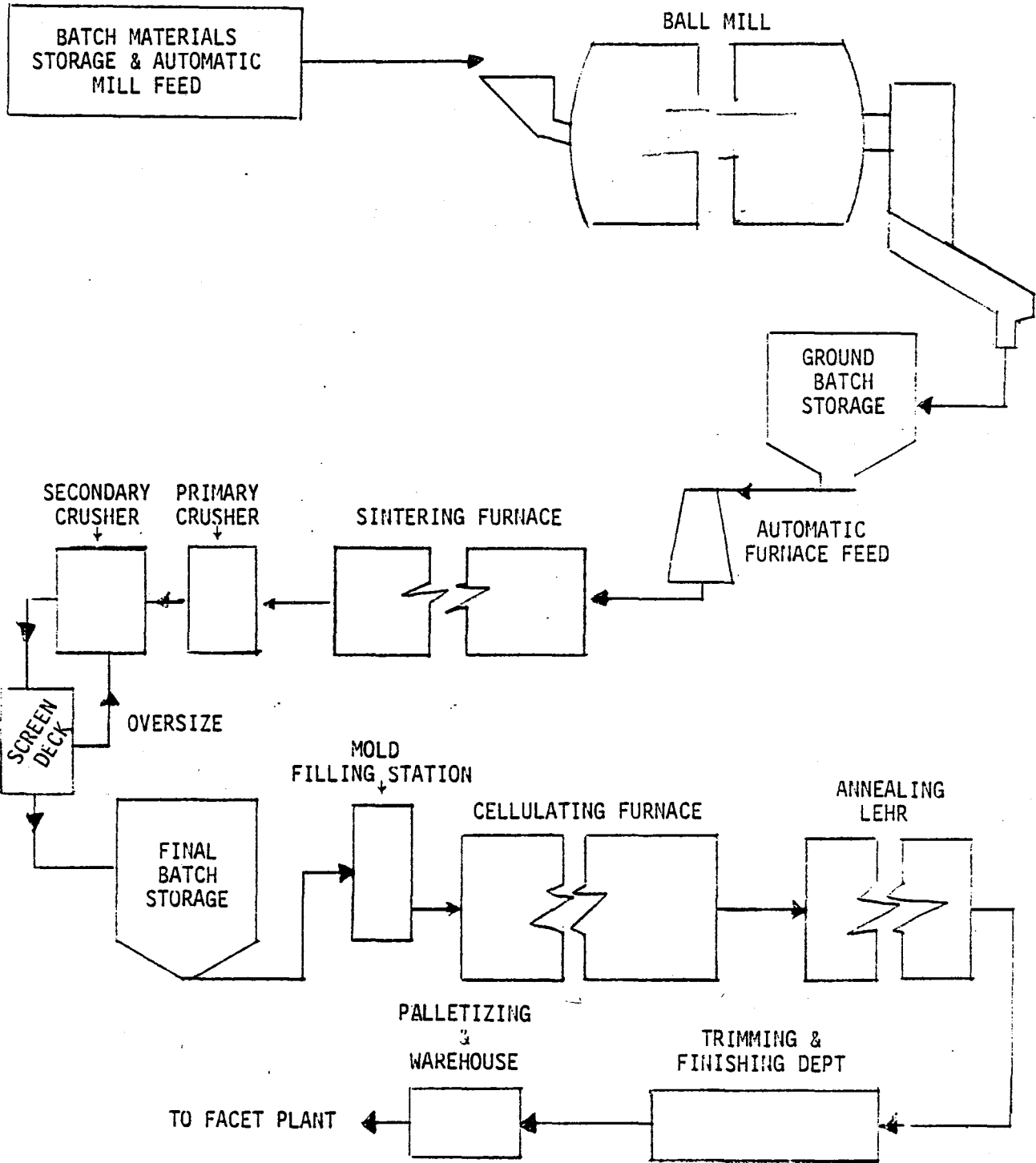


Automatic Metering and Mixing Equipment for all adhesives  
Spray Booths and Automatic Spray Equipment for glass sheet adhesive  
application  
Computer Hard and Soft Ware for Assembly Control  
Laser Light Inspection Equipment for Quality Control  
Air Compressors  
Vacuum Pumps - low vacuum, high capacity

R. Y. Greene  
6-13-80

J-I

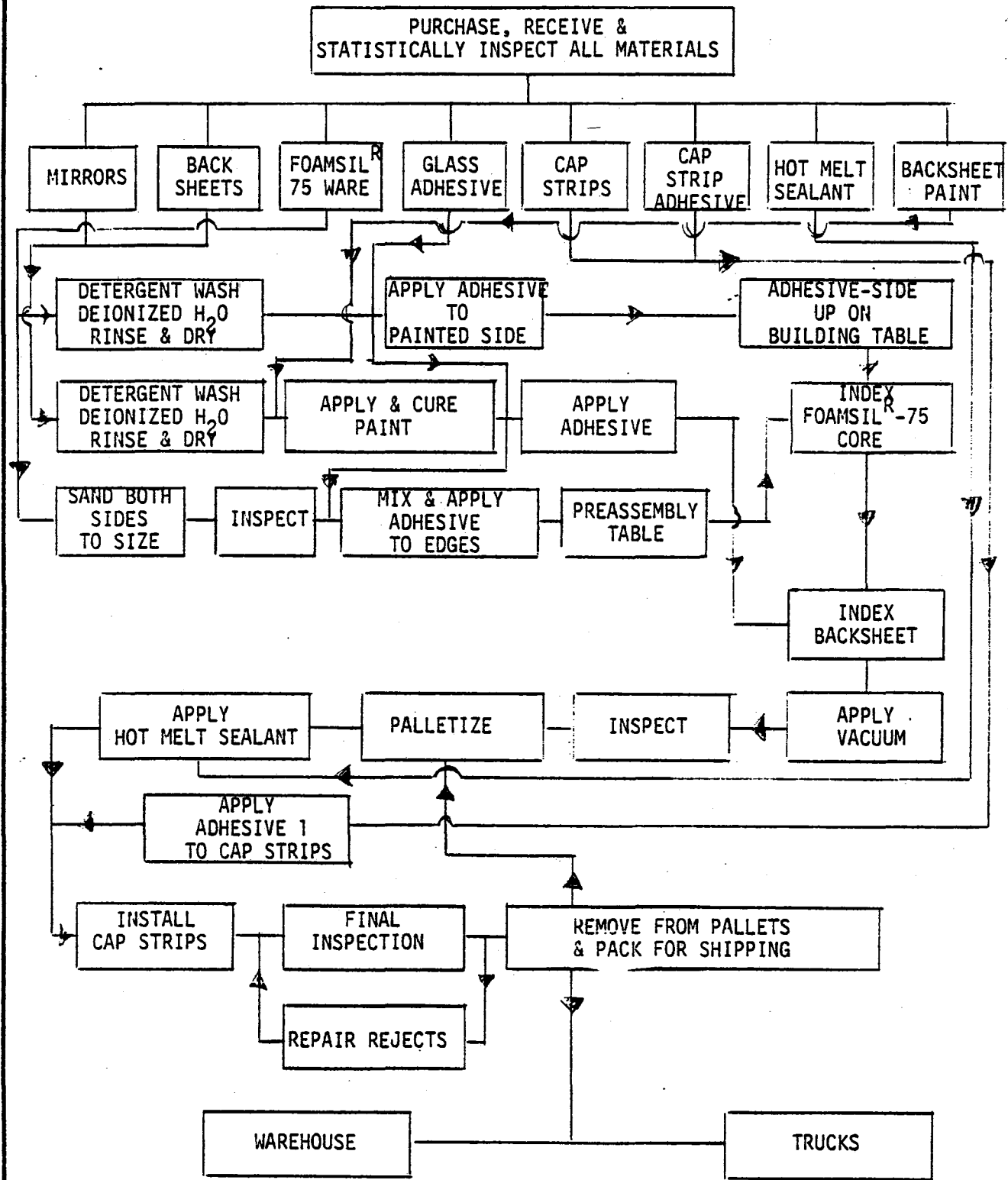
FOAMSIL<sup>®</sup>-75 Ware  
FLOW PLAN



DESIGN		SCALE		REV.	①	③	PITTSBURGH CORNING CORP. P. C. GLASS BLOCKS · P. C. FOAMGLAS 4410.1-1A	Fig. 3-1A
DRAWN	RYG	DATE	6-12-80	BY				
CHECK		DATE		DTE				

J-II

FACET PRODUCTION FLOW PLAN



DESIGN		SCALE	REV.	①	②	PITTSBURGH CORNING CORP. P. C. GLASS BLOCKS - P. C. FOANGLAS 4410.1-2A	Fig. 3-2A
DRAWN	RYG	DATE	6-12-80	BY			
CHECK		DATE		OTE			

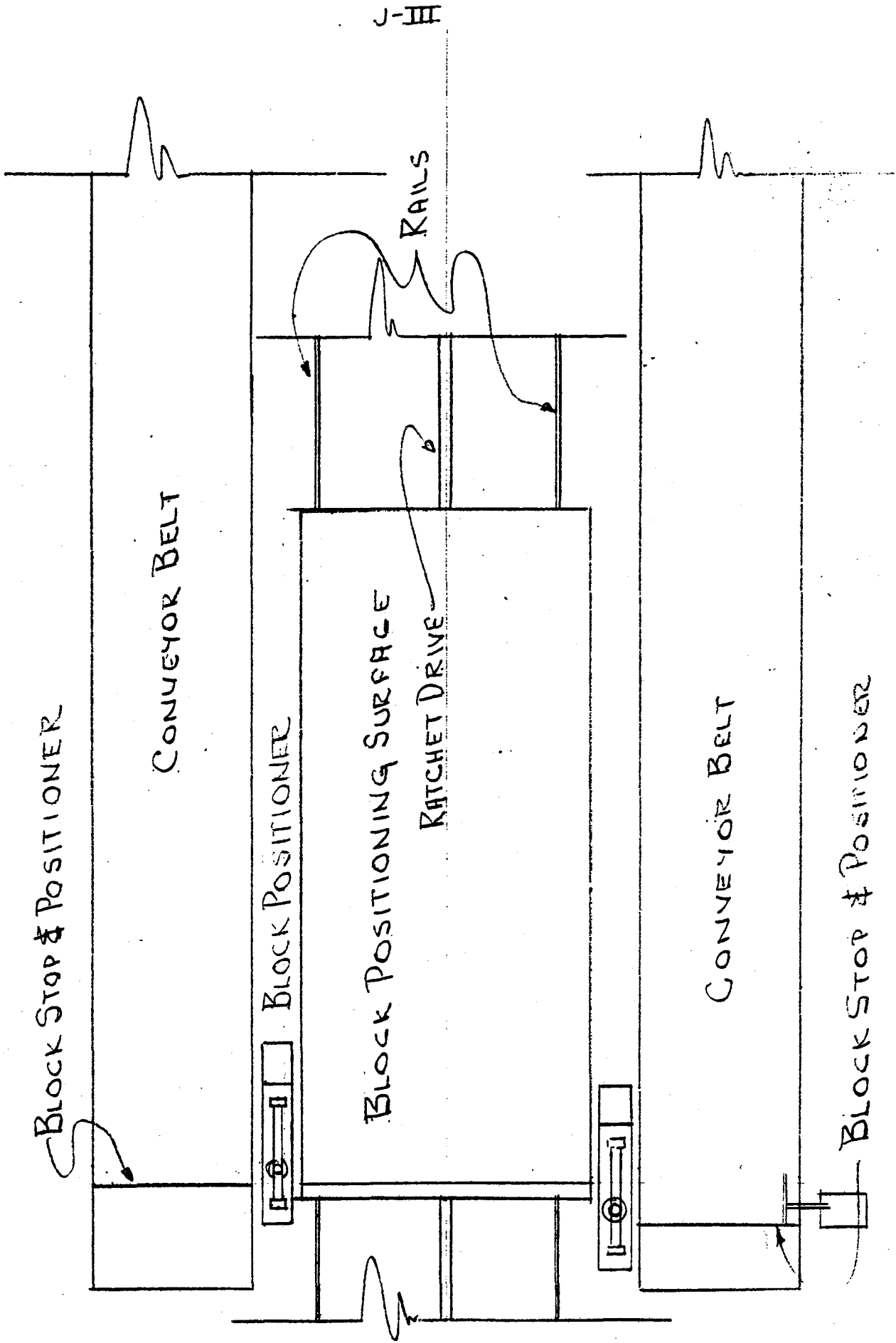


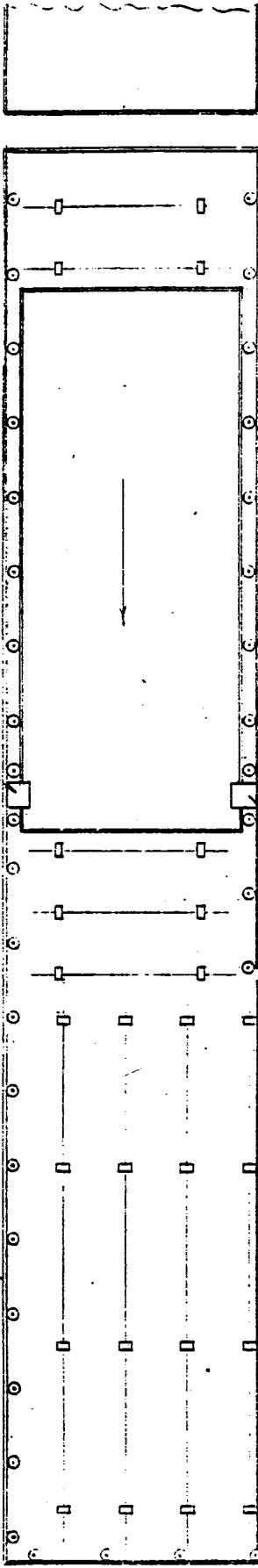
Fig 3-7

4A10.1-7

Automatic Gunning System  
For Reflecting Solar Mirrors

Automatic Conveyor

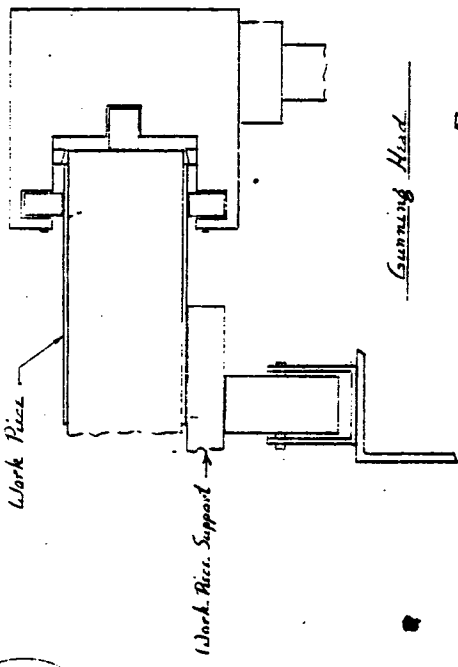
Gunning Head



J-IV

Pump

Gunning Heads



Work Piece

Work Piece Support

Gunning Head

Fig 3-10  
4410.1-10

J-V

Pittsburgh Corning Corporation  
P.O. Box 37  
Port Allegany, PA 16743  
814-642-2552

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July 14, 1980

Mr. Roger B. Gillette  
Mail Stop 9A-46  
Boeing Engineering & Construction Co.  
P. O. Box 3707  
Seattle, WA 98124

Dear Roger:

Enclosed you will find Pittsburgh Corning Corporation's best estimate as to the capital, period, and variable expenses involved in a Heliostat manufacturing plant.

In the capital cost portion you will notice that some changes have been made. Most notable are the replacement of the rail system and overhead cranes with portable gantries and fork trucks. The sources of prices were vendors, means cost estimating, Phoenix Chamber of Commerce and engineering estimates on some of the highly specialized equipment.

Three items in particular have been omitted from the facet cost estimate due to insufficient organizational data. They are: cost of financing the facet assembly plant, return on investment and profit. We realize these items are of extreme importance but since so many options are available we felt that BEC may want to furnish significant input.

There are several areas which could institute cost savings.

1. The most obvious is to use a less expensive glass. Use of a glass costing  $\$0.375/\text{ft}^2$  would save some  $\$33/\text{facet}$  (or about  $\$8.20/\text{M}^2$ ).
2. Some savings would be instituted by using a lower density FOAMSIL<sup>R</sup>-75 ware. There would be some sacrifice in strength, but it probably would not be significant. Ten pcf density ware would run about  $\$0.40/\text{board foot}$ , saving only  $\$4.46/\text{facet}$  (or  $\$1.11/\text{M}^2$ ).
3. Back sheet paint could be reduced to 1 mil meaning a saving of  $\$1.92/\text{facet}$  ( $\$0.48/\text{M}^2$ ).
4. There is a possibility of greatly simplifying the building process by elimination of the building tables and using tempered metal pallets running on conveyors and pinch rollers to press the parts together. This may also help eliminate the jointy characteristic exhibited in the prototypes. By simplifying the process the building, equipment and utility loads would be reduced (saving unknown).

J-VI

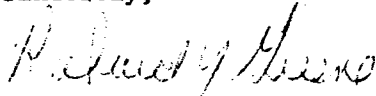
Mr. Roger B. Gillette  
July 14, 1980  
Page 2

5. A saving in management costs could be realized by combining the administrative personnel of the FOAMSIL<sup>R</sup>-75 plant and the facet plant. The savings would be about 20% or \$0.30/facet (\$0.07/M<sup>2</sup>).
6. Another savings possibility is revision of the facet shipping crate. This should be able to be reduced to \$1.25/facet with a little careful planning. Saving = \$1.03/facet (\$0.26/M<sup>2</sup>).
7. Companies are frequently granted easements on property taxes for several years as a incentive to locate in an area. This could save as much as \$0.20/facet over a 10-year time span.
8. The last area of possible revision at this time is the institution of a less expensive cap strip system. Savings would probably only total about \$1/facet (\$0.25/M<sup>2</sup>).

If all of the above items could be instituted, the possible reduction in cost per facet would be \$11.91 plus production savings for a total of \$124.32/facet (30.84/M<sup>2</sup>).

I trust this estimate meets with your approval. If any questions arise, please feel free to contact me.

Sincerely,



R. Y. Greene  
Sr. Development Engr.

RYG:jm  
Enclosure

cc: Dr. H. H. Anderson  
Mr. R. L. Lambden  
Mr. Frank Shriver

Cost Summary for 1 Facet (4' x 11' or 4.031M<sup>2</sup>) @ 600,000 Facets/yr

Materials

Mirror	\$56.68	
Backsheet	34.68	
Glass Adhesive	3.44	
Joint Adhesive	1.31	
FOAMSIL <sup>R</sup> -75 Ware	40.16	
Cap Strips	6.00	
Cap Strip Adhesive	2.50	
Butyl Sealant	0.86	
Backsheet Paint	2.88	
Sub Total		\$148.51
Total (assuming 95% efficiency)		\$155.94

Depreciation Costs

Buildings	(45 yrs)	0.28	
Land Improvements	(20 yrs)	0.11	
Machinery & Equipment	(14 yrs)	1.81	
Furniture & Fixtures	(10 yrs)	0.02	
Shipping Crates	(5 yrs)	2.28	
Total			4.50

Other Costs

Land Cost	(45 yrs)	0.09	
Other Fees & Costs	(15 yrs)	0.43	
General Utilities		0.05	
Air Conditioning		0.16	
Lighting		0.15	
Property Taxes (no exclusions)		0.46	
Total			1.34

Manpower

Labor	2.55	
Management	1.48	
		4.03

Maintenance Material Cost	0.42	<u>0.42</u>
Total Produced Cost/Facet	(\$41.17/M <sup>2</sup> )	\$166.23



## Mirror Costs

27.8MM ft<sup>2</sup>  
 631,579 sheets @ 265 sheets/crate @ 4 crates/trailer  
 @ 2 trailers/truck = 300 shipments/year  
 2120 sheets/truck load  
 Transportation charge per sheet =  $\frac{\$1.65 \times 2160 \text{ mi}}{2120}$  = \$ 1.68

## Glass Cost

$\$0.75/\text{ft}^2 \times 44 \text{ ft}^2/\text{sheet}$  = \$33.00  
 (price per Art Shoemaker 6-27-80)

## Silvering

$\$0.50 \times 44 \text{ ft}^2/\text{sheet}$  = \$22.00  
 \$56.68/sheet

## Backsheet

27.8MM ft<sup>2</sup>  
 Transportation (above) 1.68  
 Glass Cost (above) 33.00  
 \$34.68/sheet

## Adhesive Costs

Glass - 25 oz/sheet x 2 sheets = 50 oz  
 Epoxy resin \$1/lb, Frt allowed  
 Hardener \$1.20/lb, Frt allowed (average cost \$1.10/lb)  
 3.125 lbs/facet = \$ 3.44

## Joints

Consumption: 1 gm/in.<sup>2</sup> of joint area.  
 28.6% Epoxy Resin \$1.00  
 28.6% Hardener 1.20  
 42.8% Thixotrope (silica flour) \$0.08/lb Delivered  
 0.286 x 1.00 = \$0.286  
 0.286 x 1.20 = 0.343  
 0.428 x 0.08 = 0.034  
 \$0.663/lb  
 895 in.<sup>2</sup> of joint area/facet = 895 gm = 1.97 lbs = \$ 1.31/facet

FOAMSIL<sup>R</sup>-75 Ware

89.25 bd ft @ \$0.45/bd ft (1  $\sigma$  = \$0.05) = \$40.16

## Backsheet Paint

0.003 in. thick = 0.083 gallon/sheet x \$35/gallon = \$ 2.88/facet

## Cap Strips

\$ 6.00/facet

## Cap Strip Adhesive

5 lbs/facet = 1/2 gallon/facet @ \$5/gallon Delivered = \$ 2.50/facet

## Hot Melt Butyl Sealant

0.086 gallon/facet @ \$10/gallon Delivered = \$ 0.86/facet

## Salaried Staff

Plant Manager	\$50M
Plant Manager's Secretary	13M
Purchasing Agent	30M
Purchasing Clerk	12M
Personnel Manager	30M
Personnel Clerk	12M
Accounting Manager	25M
Accountant	20M
Computer Operator/Accountant	22M
Production Engineer/Manager	40M
Process Engineers 3 @ 25M	75M
Receptionist/Secretary	12M
Storeroom Clerk	12M
Plant Engineer	30M
Design Engineers 2 @ 26M	52M
Maintenance Clerk	12M
Electrical Maintenance Supervisor	30M
Mechanical Maintenance Supervisor	30M
Machine Shop Supervisor	30M
Warehouse/Shipping Supervisor	25M
Production Supervisors (Glass & FOAMSIL <sup>R</sup> Ware) 2 @ 30M	60M
Production Supervisors (Assembly & Packing) 2 @ 30M	60M
	\$682M
	x 1.3 886.6

## Hourly Employees

Shift Workers @ 53/shift @ avg. salary of \$7.50/hr	
	100 x \$7.50 750M
Day turn only 46 @ avg. salary of \$7.50/hr	345M
	1095M
	x 1.4 1533MM

Depreciation Cost Rates

Buildings (45 yrs)	<u>\$7,664,000</u>	=	0.28
	45 yrs x 600,000 Facets		
Land Improvements (20 yrs)	<u>\$1,344,600</u>	=	0.11
	20 yrs x 600,000 Facets		
Machinery & Equipment (45 yrs)	<u>\$15,231,400</u>	=	1.81
	14 yrs x 600,000 Facets		
Furniture & Fixtures (10 yrs)	<u>\$100,000</u>	=	0.02
	10 yrs x 600,000 Facets		
Facet Shipping Crates (5 yrs)	<u>\$6,400,000</u>	=	2.13
	5 yrs x 600,000 Facets		
Glass Shipping Frames (5 yrs)	<u>\$450,000</u>	=	0.15
	5 yrs x 600,000 Facets		

Utilities' Costs

General Utilities	estimated @ \$30,000/year	=	0.05
Air Conditioning	12,960 KWH/Day @ \$0.03/KWH = <u>388.80/Day</u>	=	0.15
	2400 Facets		
Lighting	12,000 KWH/Day @ \$0.03/KWH = <u>\$360/Day</u>	=	0.15
	2400 Facets/Day		

Property Taxes

Figures based on information from Phoenix area Chamber of Commerce.

Buildings	→	\$ 2,400M	
Land	→	1,344	
Improvements	→	7,664	
		<u>\$11,408M</u>	Actual Value
Assessed Value ~80% of Actual	=	9,206.4M	
Tax Base is 25%	=	2,301.6M	
Tax is 12%	=	276.2M	
		<u>\$276.2M</u>	
		600,000 Facets	= 0.46

HELIOSTAT FABRICATION PLANT SUMMARY

<u>Cost Items</u>	<u>\$(M)</u>
Land	2,400
Land Improvements	1,344
Buildings	7,664
Machinery & Equipment	15,231.4
Furniture & Fixtures	100
Shipping Hardware	<u>6,850</u>
Contractors' Fees & Permits	
Buildings	1,149.6
Equipment	1,952.9
Permits & Engineering	<u>400</u>
Sub Total: Fees & Permits	3,502.5
Total w/o Fees & Permits	33,589.4 (M)
Total w/Fees & Permits	(37,091)(M)

<u>Land</u>	<u>\$(M)</u>
#133,000	
18 Acres @ \$133/acre	2400

<u>Land Improvements</u>	<u>\$(M)</u>
Utilities	1000
Parking	
Parking lots	85
Truck docks & road	56
Plant service road	18
Rail Siding	150
Fence	<u>35</u>
TOTAL	1344

WFK 6-20-80

<u>Buildings</u>	<u>\$(M)</u>
Main Plant	5468
Fab Area	904
Office Building	123
Paint Storage	25
Cap Strip Storage	25
Rest Rooms & Lunch Rooms	96
QC Lab & Supervisors' Offices	29
Maintenance Shops	170
Warehouse Office	10
Loading Docks	60
Compressor House	17
Air Conditioning	<u>737</u>
TOTAL	7664
Contractor's Fee (15%)	(1149.6)

<u>Equipment &amp; Machinery</u>	<u>\$(M)</u>
* FOAMSIL <sup>R</sup> -75 Line	1838
* Mirror Line	2514.2
* Back Glass Line	2948.2
* Facet Assembly	5719
Warehouse Equipment	514
Accounting Computer	75
Process Control Computer	600
Compressor Equipment	215
QC Equipment	300
Maintenance Equipment	450
Storage Tanks	<u>58</u>
TOTAL	15231.4
Manufacturer's Fees (15%) (on * items only)	(1952.9)

<u>Furniture &amp; Fixtures</u>	<u>\$(M)</u>
Office Furniture	100

WEK 6-20-80



HELIOSTAT FABRICATION PLANT EQUIPMENT LIST

Site & Utilities Line Portion

<u>Equipment Description</u>	<u>#</u>	<u>\$ each</u>	<u>Total \$</u>
Land 18 acres		<sup>133,000</sup> 133/a	2400
Site Development & Utilities			1000
Paving			
Parking lots (78,300 sq ft)		1.08/SF	85
Truck roads and dock areas (52,100 sq ft)		1.08/SF	56
Plant roads (16,500 sq ft)		1.08/SF	18
Rail Siding	-	-	150
Fence (2,200 LF)		10.25/LF	23
Gates	3	4000	12
Storage Tanks (25,000 gallons - adhesive)	2	11000	22
(25,000 gallons - cap strip)	1	11000	11
(Solvent tank, buried)	1	25000	<u>25</u>
			3802

HELIOSTAT FABRICATION PLANT EQUIPMENT LIST

## Buildings Line Portion

<u>Equipment Description</u>	<u>#</u>	<u>\$ each</u>	<u>Total \$ (600)</u>
Main Plant (260.4 MSF)		21/SF	5468
Permits & Engineering			400
Interior Fab Area (132 MSF)			904
Air Conditioning/Heating			714
Office Building (3000 sq ft)	3000	41/SF	123
HVAC	-	7.60/SF	23
Furnishings	-	-	100
Computer Accounting	-	-	75
Paint Storage (1200 sq ft)	1200	21/SF	25
Cap Strip Storage (1200 sq ft)	1200	21/SF	25
Compressor House	800	21/SF	17
Compressor Equipment			215
Rest Rooms & Lunch Rooms (3840 sq ft)		25/SF	96
QC Lab Area & Supervisors' Offices	1920	15/SF	29
Process Control Computer System	1	-	600
QC Equipment	1	-	300
Maintenance Shops	3000	56.67/SF	170
Maintenance Equipment	-	-	<u>450</u>
			9734

HELIOSTAT FABRICATION PLANT EQUIPMENT LISTFOAMSIL<sup>R</sup>-75 Ware Line Portion

<u>Equipment Description</u>	<u>#</u>	<u>\$ each</u>	<u>Total \$</u>
Pallet Conveyor to "West" Line	400'	100/ft	40
pallet Unloading Machine	4	50	200
Inspection	4	50	200
Scrap crusher	2	50	100
Sander	8	20	160
Turnover	4	10	40
Deduster	4	20	80
Adhesive Application	4	16.5	66
Halving Saw	4	40	160
Distribution Conveyors	784'	200/ft	157
Block Feed Mechanism	8	20	160
Block Pickup and Locating Machine	8	20	160
Dust Collection (@ 15 MCFM each)	3	105	<u>315</u>
			1838

HELIOSTAT FABRICATION PLANT EQUIPMENT LIST

Mirror Line Portion

<u>Equipment Description</u>	<u>#</u>	<u>\$ each</u>	<u>Total \$</u>
Unstacker	2	45	90
Inspection Station (optical)	2	100	200
Reject Transfer	1	45	45
Turnover	4	15	60
Glass Cleaning Booth	2	40	80
Adhesive Application Station	2	72.6	145.2
Adhesive Removal	1	40	40
Mirror Conveyor System			
5'	358	675/ft	242
12'	560	1800/ft	1008
Corner transfers	23	20M	460
Mirror Transfer Assembly	9	16	<u>144</u>
			2514.2

HELIOSTAT FABRICATION PLANT EQUIPMENT LIST

## Back Glass Line Portion

<u>Equipment Description</u>	<u>#</u>	<u>\$ each</u>	<u>Total \$</u>
Unstacker	2	45	90
Reject Transfer Line	1	45	45
Glass Cleaning Booth	2	40	80
Turnover	2	15	30
Paint Booth	2	150	300
Adhesive Application	2	72.6	145.2
Adhesive Clean Off	1	40	40
Back Glass Conveyor System			
5'	274	675/ft	913
12'	507	1800/ft	185
Corner transfers	16	20M	320
Back Glass Transfer Machine	16	50	<u>800</u>
			2948.2

HELIOSTAT FABRICATION PLANT EQUIPMENT LIST

## Facet Assembly Line Portion

<u>Equipment Description</u>	<u>#</u>	<u>\$ each</u>	<u>Total \$</u>
Building Tables	32	50	1600
Facet Transport Conveyor System			
5' wide	776	675/ft	524
12' wide	914	1800/ft	1645
Corner transfers	28	20M	560
Optical Inspection	2	100	200
Edge Strip Installation	2	100	200
Corner Clip Installation	2	25	50
Butyl Caulk Station	2	120	240
Turnover	4	15	60
Visual Inspection	2	20	40
Packing stations	2	300	<u>600</u>
			5719

HELIOSTAT FABRICATION PLANT EQUIPMENT LIST

## Warehouse Line Portion

<u>Equipment Description</u>	<u>#</u>	<u>\$ each</u>	<u>Total \$</u>
FOAMSIL <sup>R</sup> -75 Material Pallet Conveyor System	250'	100/ft	25
Glass Truck Unloading Crane	1	50	50
Fork Trucks	9	35	315
Facet Crate Conveyor	360	150/ft	54
Loading Dock	6	10	60
Warehouse Office			10
Back Glass Handling System			
Tow car w/carts			70
(Equipment Sub Total			514)
			584

Shipping Hardware

Facet Shipping Crates	2000	3.2	6400
Glass Shipping Frames	300	1.5	450

## FACET PLANT SALARIED PERSONNEL

Plant Manager	1
Plant Manager's Secretary	1
Purchasing Agent	1
Purchasing Clerk	1
Personnel Manager	
Personnel Assistant	1
Accounting Manager	1
Accountant	1
Computer Operator/Accountant	1
Production Engineer/Production Manager	1
Production/Process Engineers	3
Receptionist/Secretary	1
Storeroom Clerk	1
Plant Engineer	1
Design Engineers	2
Maintenance Clerk	1
Electrical Maintenance Supervisor	1
Mechanical Maintenance Supervisor	1
Machine Shop Supervisor	1
Warehouse/Shipping Supervisor	1
Production Supervisor (Glass & FOAMSIL <sup>R</sup> lines) (each shift)	2
Production Supervisor (Assembly & Packing lines) (each shift)	<u>2</u>
Total Salaried Personnel (2 shifts)	27



## FACET PLANT HOURLY MANNING

<u>Shifts</u>		<u>Relief</u>
<u>Fab Plant</u>		
Operators	14	2
Inspector/Operators	2	
Inspectors	8	2
Laborers	6	1
Utility	6	-
Shipping & Warehouse men	9	1
<u>Shift Maintenance</u>		
Electrician	1	
Mechanic	1	
<u>Total Hourly Shift Workers per shift</u>		53
<u>Day Turn Hourly Support</u>		
Machine Shop	12	
Mechanics	15	
Electricians	12	
General Maintenance	5	
Janitors	2	
<u>Total Day Turn Workers</u>		46

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