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REMINGTON ARMS COMPANY, INC.

FIREARMS PROCESS RESEARCH DIVISION

FIRST QUARTER REPORT

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RECEIVER FLEXIBLE MANUFACTURING SYSTEM

BASIC DATA

Basic Data is presently being prepared with assistance from the Engineering Department. Its scheduled completion date has slipped from April 1984 to May 1984. Copies of the rough draft of the basic data have been forwarded to Ilion Plant Management with reviews of the data to begin on March 29, 1984.

EQUIPMENT

The Snyder machine runoff/acceptance tests in Detroit have been delayed approximately one month due to various problems. Most of the problems have been with subvendor components including; incorrect drive axis motors, an additional voltage limiting transformer requirement, and revisions to the GE executive software. Customer acceptance tests at Snyder are now scheduled to begin in late April with M/1100 Receiver machining tests following in early May. The NC program that will be used to demonstrate machine acceptance was prepared by Jim Roedershiemer, EDL and has been checked out at GE.

All of the cutting tools needed to demonstrate the Snyder machine are expected to be shipped to Detroit by the end of March pending a decision by EDL as to where the tools will be assembled and preset, EDL, Remington, or Snyder. The tool holders and boring bars are currently at EDL and the other cutting tools are at Remington. Tentative arrangements to preset the tools using R&D's facilities have been made. EDL is currently checking with Wilmington Shops and Snyder for more accurate equipment. The cutting tools required for Receiver machining tests should be available by mid April.

LAYOUT

On Wednesday, February 22, a visit was made to T. Bentley at the Louviers Building in Wilmington. Various ideas for the placement of the Receiver FMS in Bldg. 60 were discussed. Building restrictions were pointed out. The Intergraph CAD system was utilized to generate a layout incorporating these restrictions.

A layout of the Receiver FMS in building 60 has been generated that shows the load/unload areas utilizing monorail track spurs. These spurs allow a higher degree of flexibility than previous designs and should make the load/unload stations cost less (due to stationary locations).

Further revisions to this layout will be necessary as the system becomes more refined. This will also affect the installation layouts which show the rearrangements required to implement each phase of the system.

ECONOMICS

The internal rate of return (IRR) has been calculated for various cases of the Receiver FMS economics.

The first case was based on I.E. estimate figures dated 2-21-84. This case assumed no capital avoidance allowances. The IRR for this case was 16%.

The second case was based on I.E. estimate figures dated 2-21-84. This case assumed capital avoidance allowances inputted after 1990. The IRR for this case was 19%.

The third case was based on I.E. estimate figures dated 2-21-84. This case assumed capital avoidance allowances inputted after 1986. The IRR for this case was 21%.

The fourth case was based on I.E. estimate figures that were modified to reflect greater maintenance savings. This case assumed capital avoidance allowances inputted after 1990. The IRR for this case was 20%.

The fifth case was based on I.E. estimate figures that were modified to reflect greater maintenance savings. This case assumed capital avoidance allowances inputted after 1986. The IRR for this case was 22%.

The capital avoidance allowances used in the above evaluations have been largely based on historical data.

SMALL PARTS FMS

Specifications for the machining center which is to be purchased as part of the Small Parts FMS prototype project are nearly complete. EDL has reviewed and revised them based on their experience with the receiver machine. The specifications will be completed and delivered to Purchasing in early April for vendor quotations.

A discussion of the machining center specifications and Small Parts FMS concept was conducted with Dick Collins on Thursday, March 22 to keep EDL informed on the latest developments. Meetings of this type are essential to assure computer control and manufacturing process compatibility between the receiver and small parts systems.

SERIAL NUMBER RECORDING SYSTEM - PHASE II

On Friday March 9, Dan Shumway, Mark Courage, and Jim Czelusniak visited Computer Identities (CI) to discuss system specifications, some minor revisions and project progress. Meetings of this type will be conducted on a monthly basis to ensure CI-Remington communication and cooperation. The next meeting is scheduled for early April.

Most of the past month has been spent organizing the recently formed project team. All members have been to at least one meeting and most have met individually with Dan and Jim to discuss their specific duties and concerns. The team concept has been instrumental in getting those who will use the system involved in the early design activities and delegating work to those who are best qualified.

Recent inquiries into project accounting has uncovered a probable overrun in allocated operations money. Previous operations expenditures totalling \$58M spent during Phase I trial and pilot was not accounted for when the Phase II project was written. Thus, at the present time, an overrun of \$58M of operations money is anticipated. A separate letter has been issued describing details of this matter.

GFM AUTOMATION

All equipment has been installed and is now being debugged, along with system and robot programs. The system is now producing parts automatically at a cycle time of 1:44 (versus a goal of 1:30). Because the robot waits for the GFM to complete its cycle, the critical element for cycle time is the speed with which the robot can unload and load the GFM.

Minor mechanical changes have been made to improve system reliability. Cutting off hot barrels has presented several unexpected problems:

- o tool wear: the life of standard (high-speed steel) saw blades was reduced by 90% to an unacceptable level; carbide blades are now being tested
- o metal shrinkage: a hot barrel will shrink almost 0.1" after it is cut off; this can be compensated for because it is repeatable when the system cycles continuously
- o runout: the muzzle end cut is not square with the barrel, apparently due to shrinkage during the cut

Operator training is tentatively scheduled to begin March 26, with Trial and Pilot beginning the following week. System documentation will be updated at EDL and Ilion during April to reflect changes made during installation and debugging.

\$5M was charged to the capital budget, and \$11M to operations in February. This brings total capital expenditures so far to \$297M (105% of \$282M allocated for the first system), and total operations expenditures to \$166M (93% of \$178M). Both capital and operations are expected to finish within 10% of forecast.

Although the capital project anticipated automation of two GFM systems, there are no definite plans to proceed with the second system. It would only be burdened 14% in 1985 based on three-shift operation at current forecast levels. Because of the low burdening, the third-year ROI for a second system would be only 3%. Even if a second full system is not economically feasible, much of the control and instrumentation technology developed for the first system could be applied to manually-loaded GFM's.

FLEXIBLE ASSEMBLY SYSTEM

EDL has been concentrating their efforts on development of a flexible feed (vision) system capable of feeding parts to the assembly system. They have been using an Automatrix Vision System, and feel that it will be advantageous to use it - rather than dedicated feeder bowls as originally estimated - for our prototype system. A vision system would greatly increase our future flexibility in the development of assembly systems. Firm estimates are not expected until April, but the change is expected to result in increased development costs for less expensive equipment on both the prototype and future projects.

Detail design is essentially complete for the breech bolt and trigger assembly workstations.

The Puma 560 robot was received in early March.

BRAZING AUTOMATION

Our Development Contract with Fusion has been completed. Barrels from their proposed process have been tested satisfactorily for both strength and endurance. Third-year NROI has been estimated at 33%.

We are still waiting for more samples from Lucas-Milhaupt for comparison.

WOOD FINISHING AUTOMATION

Testing is continuing on the DeVilbiss rotary atomizers. A third test was run which utilized the operating ranges developed from the Box-Behnken approach of the first two. In this test fore ends were only indexed four times rather than continuously. Results were good overall but further development is required. The tests had been set up to utilize the fact that the first and last part of a group attracts more finish than the middle parts. Thus parts were sprayed in groups of three with the part of interest in the middle. It was discovered in the third test that a group of parts larger than three appears to spray much better. Future tests will be run with larger groups of parts.

DeVilbiss and DuPont's Marshall labs were contacted to obtain additional information to help eliminate the minor problems that are being encountered. It was suggested to try adding a different solvent to the RKW in an effort to get better spraying results. A fourth test has been planned which will utilize this information.

Lilly Industrial Finishes has responded that they have no real interest in developing a U.V. coating for gun stocks. Red Spot Paint and Varnish Company has supplied two more samples of U.V. finishes on stocks we provided. Coating thickness appeared good. Water soak tests were poor on raw wood samples and adhesion was poor on both raw and pressed wood. Red Spot will be contacted to determine if further development is possible.

AUTOMATED FORE END SANDING

In conjunction with Foster Miller Inc.'s proposal for a fore end sanding machine, tests were conducted 3/8/84 at the 3M Coated Abrasives Methods Center in St. Paul, Minnesota.

Several basic concepts were tested. These included rough machining of the exterior shape from a blank as well as finish sanding of a rough contoured piece. The basic tests were performed on a molding sander which is essentially a large slack belt machine (225 inch belts) with an adjustable table (Z and Y directions) and a table saw square for feeding the work in the X direction. The forms for contouring the sanding belt to the desired shape were made of birch with the desired profile machined in them. These blocks showed little wear during the tests and it is felt that a chrome plated steel cam would be virtually impervious to wear. The tests showed that the majority of a fore end can be sanded with belts, but complete sanding of all fore ends is probably infeasible. This is due to a 10 degree maximum lead in and out angle of the sanding belts which limits the ability of the belt to quickly change shape for three dimensional contouring work.

The conclusions reached at the end of the testing were that at this point in time a basic machine cannot be designed until further testing is carried out. The testing would utilize equipment similar to the 3M test with the addition of a conveying system for the parts and a simple contouring cam. It was generally agreed that this testing could best be performed at Remington, by Remington personnel, because of the subjective quality standards involved. Rough economics and alternate ideas are being developed to determine if there is an optimum process which can be developed utilizing the Foster Miller concept that would allow complete sanding of a fore end.

BIRCH FINISHING

Economics are now being developed to determine the feasibility of using the current electrostatic line to stain, seal, and finish-coat lacquer on birch parts. Initial staining tests on the rotary atomizers sprayed Sportsman 12 fore-ends completely with even coverage. The press checkering and ends were also well-coated. Too much stain was sprayed on the parts, causing them to appear black. A few electrostatically stained fore-ends were also electrostatically sealed with lacquer, which did not cause any runs or streaking. Tests are being planned to reduce the amount of stain sprayed on the part and improve the color.

AUTOMATIC LONG STOCK SANDING

Many concepts for sanding long stocks automatically have been gathered. Economics for some form of automatic system look promising. Equipment vendors are being contacted for feasibility tests.

CUT CHECKERING DEVELOPMENT

o Stocks - Bostomatic

Tool design requests have been issued to P.E. &C. for detail design and build of fixturing and adjustable floating heads for the 870 Restyle. Approximately 80% of the work has been turned over to the Plant tool room for fabrication. The remainder will follow by April 1.

o Fore Ends - CO.RE.MA.

The six spindle CO.RE.MA. has been accepted. Two (2) prototype fixtures have been completed for the 870 Restyle fore end. When approved, we will finalize drawings and order the six (6) fixtures required for production.