

cc: R. E. Fielditz
C. B. Workman
H. K. Boyle
T. L. Capeletti
R. H. Collins

REMINGTON ARMS COMPANY, INC.
FIREARMS MODERNIZATION DIVISION
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- RECEIVER FLEXIBLE MANUFACTURING SYSTEM

A special Automation Review Committee has been formed of EDL and Remington personnel to study and recommend additional automation options that should be included in the Receiver FMS software and scope. Several options are currently being evaluated including: automatic material handling, automatic scheduling, MRP interfacing, production reporting, and process monitoring. In addition, the Automation Committee is studying the "transportability" of receiver manufacturing system software and to other proposed Firearms Modernization systems including Small Component Manufacturing. This committee will report their recommendations and high spot economic analyses to the Firearms Modernization Planning Committee in early July.

- GFM AUTOMATION

The new mandrel assembly/stripping machine has been designed and fabricated. The Cincinnati Milacron T-3 robot has been ordered and is scheduled for delivery to Ilion in September. The modifications to the cut-off machine are scheduled to be complete in September. Software programming of the system controller is in progress and is scheduled for completion and simulation in August. Total system installation will begin in October with full production of one automated GFM scheduled by year end.

- FLEXIBLE ASSEMBLY SYSTEM FOR SMALL COMPONENTS

Initial tests at EDL have demonstrated the technical feasibility of automatically assembling these components provided minor design changes can be made to four parts. Preliminary economic analysis indicates an IRR of 24% on an investment of \$470M.

Additional testing will be conducted in July to accurately determine the investment requirements and system operation. Detailed economics will be developed at that time.

In addition, FM will investigate the proposed part design modifications with Research and Purchasing.

- SERIAL NUMBER RECORDING SYSTEM - PHASE II

The Phase II project has been approved and Purchasing is currently negotiating the system performance warranty with the proposed vendor, Computer Identics. The system will be ordered upon completion of the negotiations.

- WOOD SHOP FLEXIBLE MANUFACTURING SYSTEM

1. CNC Long Stock Inletting

The Heian machine has been purchased and installed to perform the secondary machining operations for all long

stocks. Machine controllability studies indicate that the Heian is producing more accurate stocks than the existing production equipment and stocks have been processed thru assembly with no problems. Operator training is currently in progress and the Heian is running limited M/7 production.

2. Rotary Bell Atomizers

Initial start-up of the equipment was unsuccessful due to oil contamination of the atomizer air control lines.

An air dryer has been ordered for the main compressed air line for the electrostatic spray room with delivery expected in early July. Upon installation, the oil contamination of the atomizer control lines can be removed and new operation tests will be rescheduled.

• ULTRAVIOLET WOOD FINISHING

Remington and Marshall Labs personnel met in May to discuss the feasibility of this technology being applied to wood finishing production. Although no conclusion could be developed in the meeting, Marshall Labs representatives agreed to provide technical assistance to Remington as required in the investigation of U.V. finishing as well as other automated finishing developments.

• FLEXIBLE MANUFACTURING SYSTEM - SMALL METAL COMPONENTS

Initial machining tests have resulted in an efficient part fixture design and acceptable machining cycle times for several of the cuts have been developed.

Additional testing is scheduled in July to further develop the optimum tooling and resultant cycle times.

In addition, Remington and EDL engineers are investigating the feasibility of utilizing the Receiver FMS software to control the Small Metal Components FMS.

• TOTAL PLANT MODERNIZATION ECONOMICS

1992 costs and volumes were used in calculating the total plant modernization economics. The average factory cost per gun would be reduced by \$55, for a gross annual savings of \$49MM. This is based on \$102MM in capital expenditures. The net return on investment is 51% with an internal rate of return of 66%. A savings of \$39MM in working capital will also occur due to lower gun costs and shorter lead times.

Additional economics will be developed for a fifteen and a twenty year modernization plan in the third quarter.

• OFFICE COMPUTER SYSTEM

The DEC Mate II word processing system has been delivered and installed. Training and basic word processing functions are in progress.

RECEIVER FLEXIBLE MANUFACTURING SYSTEM

Remington and EDL personnel have developed a conceptual FMS system for manufacturing rectangular and bolt action receivers. The main machining component, a four spindle CNC machining center, will be custom built to meet Remington's requirements. A \$1.6MM project has been recently approved and will include a demonstration of all critical system technology including, the machine and fixturing, tooling and tool support, the inspection and material handling concepts and the computer communication system required to tie these components together. A purchase order for the prototype four spindle CNC machining center, based on Snyder's final quote, is expected to be released in June. Installation of the machine at EDL is scheduled for early second quarter 1984.

A special Automation Review Committee has been formed of EDL and Remington personnel to study and recommend additional automation options that should be included in the Receiver FMS software and scope. Several options are currently being evaluated including: automatic material handling, automatic scheduling, MRP interfacing, production reporting, and process monitoring. In addition, the Automation Committee is studying the "transportability" of the receiver manufacturing system software to other proposed Firearms Modernization systems including Small Component Manufacturing. This committee will report their recommendations and high spot economic analyses to the Firearms Modernization Planning Committee in early July.

Development of an automatic inspection system is progressing. Remington and EDL engineers have recently attended equipment demonstrations at Bendix and Brown & Sharpe. Although both systems were capable of performing the required inspection operations on M/870 receivers, the Bendix "Cordax" equipment measured the receivers four times faster than the Brown & Sharpe equipment. Bendix is currently investigating the feasibility of mounting four probes on their existing system to match the proposed manufacturing system.

GFM AUTOMATION

Remington and EDL personnel have developed a robot system designed to automate the shotgun barrel GFM machines. The total system will be capable of loading and unloading the GFM machines, stripping the finished barrel from the mandrel, reassembling the barrel blank and the mandrel, and loading and unloading the automated cutoff machine.

The newly designed mandrel assembly/stripping machine will be regrouped with the GFM and cut-off machine such that all can be operated by the robot. The existing cut-off machine will be equipped with automatic clamping to accommodate robot loading.

An Appropriation Request for \$570M to automate two shotgun GFM groups has been authorized.

The new mandrel assembly/stripping machine has been designed and fabricated. The Cincinnati Milacron T-3 robot has been ordered and is scheduled for delivery to Ilion in September. The modifications to the cut-off machine are scheduled to be complete in September. Software programming of the system controller is in progress and is scheduled for completion and simulation in August. Total system installation will begin in October with full production of one automated GFM scheduled by year end.

FLEXIBLE ASSEMBLY SYSTEM FOR SMALL COMPONENTS

Remington and EDL engineers are developing an automatic assembly system for small firearm components using a combination of programmable assembly robots and part feeding automation.

The following assemblies have been selected for inclusion in the initial system due to their current high labor requirements and high volumes: shotgun breech bolts, common triggers, M/700-7 trigger housings and shotgun carriers.

Initial tests at EDL have demonstrated the technical feasibility of automatically assembling these components provided minor design changes can be made to four parts. Preliminary economic analysis indicates an IRR of 24% on an investment of \$470M.

Additional testing will be conducted in July to accurately determine the investment requirements and system operation. Detailed economics will be developed at that time.

In addition, FM will investigate the proposed part design modifications with Research and Purchasing.

SERIAL NUMBER RECORDING SYSTEM - PHASE II

The Serial Number Recording System (SNRS) is a computerized data collecting and storage system using bar coding technology to efficiently and accurately collect production totals.

Phase II will expand the current system to include shipping and inventory control. Benefits will include automatic data collection and processing, improved inventory control, and greater shipping record accuracy.

The Phase II project has been approved and Purchasing is currently negotiating the system performance warranty with the proposed vendor, Computer Identics. The system will be ordered upon completion of the negotiations.

Equipment delivery and software engineering is expected to require approximately five months after the order is placed.

WOOD SHOP FLEXIBLE MANUFACTURING SYSTEM

Conceptual long range modernization plans for the Wood Shop include a flexible machining system (FMS) for carving and sanding. Engineering development has been initiated (but temporarily delayed) to develop a CNC system capable of carving stocks to close tolerances. Accurately carved stocks will facilitate automatic stock sanding more readily. Automatic carving and sanding would become the basis for the Wood Shop FMS. The modernization study of the Wood Shop has yielded two cost reduction proposals which have been developed into separate projects to provide immediate economic benefit.

1. CNC Long Stock Inletting

The Heian machine has been purchased and installed to perform the secondary machining operations for all long stocks. Machine controllability studies indicate that the Heian is producing more accurate stocks than the existing production equipment and stocks have been processed thru assembly with no problems. Operator training is currently in progress and the Heian is running limited M/7 production.

The second fixture will be installed on the Heian machine in early July and the machine will then be ready for Production turnover.

2. Rotary Bell Atomizers

- Review of the wood finishing area indicated an improvement would result by replacing the present Graco electrostatic spray guns with DeVilbiss rotary bell atomizers. Vendor tests indicated that the finish quality could be improved and material usage could be reduced over 40%.

Two rotary bell atomizers were purchased and installed on the existing plant electrostatic spray line.

Initial start-up of the equipment was unsuccessful due to oil contamination of the atomizer air control lines.

An air dryer has been ordered for the main compressed air line for the electrostatic spray room with delivery expected in early July. Upon installation, the oil contamination of the atomizer control lines can be removed and new operation tests will be rescheduled.

ULTRAVIOLET WOOD FINISHING

Remington is currently investigating the feasibility of utilizing ultraviolet finishing on all wood products. Ultraviolet finishing is a process in which a specially

formulated, high solids finish is sprayed on the wood and cures completely in approximately 30 seconds when exposed to ultraviolet light. Since no hazardous solvents are required for curing, this special finish can be applied much thicker (up to 3X) than our current finishes. This process has been successfully utilized in Europe in the furniture industry for several years but has only recently been introduced in the U.S.

The main area of concern is the high toxicity of the U.V. finish and whether such a finish could be safely adopted by Remington.

Initial tests conducted by Remington personnel at the vendor's facility were favorable utilizing both urethane and polyester finishes. Additional testing is being scheduled in August to continue process development, determine the economic potential, and address the toxicity question.

Potential production applications for the process include; automating the current manual stock fill and pad area by spraying high solids urethanes, one coat spraying of press form stocks, streamlining the current stock repair process for open grain and pit problems and finally base and top coating of all wood products.

Remington and Marshall Labs personnel met in May to discuss the feasibility of this technology being applied to wood finishing production. Although no conclusion could be developed in the meeting, Marshall Labs representatives agreed to provide technical assistance to Remington as required in the investigation of U.V. finishing as well as other automated finishing developments.

FLEXIBLE MANUFACTURING SYSTEM - SMALL METAL COMPONENTS

The Firearms Modernization group has initiated development of an FMS system for machining smaller metal firearms components. Shotgun breech bolts have been selected for initial development due to the high volume requirements and a large savings potential.

The initial conceptual design has been completed. The system will utilize CNC multi-spindle machining centers in combination with existing machines. Material handling and machine loading will be handled by a combination of operators, conveyors, and robots.

Initial machining tests have resulted in an efficient part fixture design and acceptable machining cycle times for several of the cuts have been developed.

Additional testing is scheduled in July to further develop the optimum tooling and resultant cycle times.

In addition, Remington and EDL engineers are investigating the feasibility of utilizing the Receiver FMS software to control the Small Metal Components FMS.

Although the receiver software will not be totally transferable to the small metal parts, preliminary investigations have revealed that a majority of the software can be applicable

if the manufacturing parameters of the small metal parts system are documented and referenced while designing the receiver manufacturing system software. FM is currently working to this goal.

TOTAL PLANT MODERNIZATION ECONOMICS

The goal of Firearms Modernization is to improve Remington's overall competitive advantage in the firearms industry. An analysis of the economic impact of a ten year modernization plan has been completed to demonstrate the benefits of modernization to Remington. Modernization will be accomplished through the use of computers, CNC machining centers, and robots that will be combined together to create flexible machining systems.

The major economic advantages of modernization are:

- . Lower labor and direct expense costs
- . Reduced overhead costs through office automation
- . Decreased work-in process and finished goods inventories
- . Machine and system flexibility
- . High consistent quality
- . Market flexibility

In order for Remington to achieve these advantages, an aggressive capital expenditure plan must be pursued. 1992 costs and volumes were used in calculating the total plant modernization economics. The average factory cost per gun would be reduced by \$55, for a gross annual savings of \$49MM. This is based on \$102MM in capital expenditures. The net return on investment is 51% with an internal rate of return of 66%. A savings of \$39MM in working capital will also occur due to lower gun costs and shorter lead times.

Additional economics will be developed for a fifteen and a twenty year modernization plan in the third quarter.

OFFICE COMPUTER SYSTEM

The DEC Mate II word processing system has been delivered and installed. Training and basic word processing functions are in progress.

In addition to having the ability to handle the word processing needs of the group, this equipment has the additional advantage of being able to function as a VT-100 terminal and provide the means of accessing existing engineering software available at EDL.

The required access codes and procedures are currently being established for Firearms Modernization's access to the EDL computer.

STOCK VENDOR STUDY

Firearms Modernization has reconfirmed, with Purchasing's assistance that there are no stock manufacturing vendors currently operating in this country. Overton previously manufactured a portion of Winchester's stocks, but Purchasing has been unable to contact them in the past month.

A list of wood furniture manufacturers, (all previous Dupont wood finishes customers) has been provided by Don Condon and Phil Allen. FM is attempting to develop management contacts to visit these plants and explore their interests in becoming stock vendors.