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

Specifications for a computer controlled monorail handling system to service the proposed FMS are being finalized jointly by Engineering Department and Remington personnel. Several monorail system manufacturers and installations are currently being investigated to evaluate equipment and discuss detailed requirements. Formal quote packages will be issued to selected vendors in early October, for both a prototype system and a full production monorail system. In addition, these selected equipment vendors will quote on an Automatic Guided Vehicle System (AGVS) to be economically compared with the proposed monorail system.

GFM AUTOMATION

The Cincinnati Milacron T-3 robot, the mandrel assembly/stripping machine and the system controller have been delivered to Ilion and installation is in progress. Unfortunately, the recent plant man-power reductions will result in a development delay due to electrician and machinist shortages. Trial and Pilot of this system is scheduled to begin in November.

AUTOMATED FLEXIBLE SUB-ASSEMBLY

EDL and Remington personnel are currently developing a Construction Cost Estimate (CCE) for the prototype project and will be complete in October. A detailed economic evaluation will be made at that time.

FLEXIBLE MANUFACTURING SYSTEM - SMALL METAL COMPONENTS

Engineering Department and Remington personnel are currently developing a Venture Guidance Appraisal (VGA) for both the prototype and production facilities.

WOOD SHOP MODERNIZATION1. CNC Long Stock Inletting

The Heian machine is fully operational, and has been released to production. Ilion Industrial Engineering will estimate the operating cost savings due to this equipment in November.

2. Rotary Bell Atomizers

Retesting of the DeVilbiss Rotary Atomizers has begun and initial results look promising. Hanging the fore ends upside down appears to reduce the buildup of finish on the lower part edges. Experimental hangers are being built to make an extended test of this condition.

ULTRAVIOLET WOOD FINISHING

Remington is currently obtaining non-disclosure agreements from the UV curing vendor before additional tests are scheduled.

WOODWORKING MACHINERY AND SUPPLY SHOW

Remington personnel recently attended the Woodworking Machinery and Supply Show in Los Angeles.

SERIAL NUMBER RECORDING SYSTEM - PHASE II

The Phase II project has been approved and plant preparation for installation has begun. Meetings have been scheduled with Plant Systems personnel to discuss software changes and other Phase II requirements.

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 machining center has been released and installation of the machine at EDL is scheduled for early second quarter 1984.

Specifications for a computer controlled monorail handling system to service the proposed FMS are being finalized jointly by Engineering Department and Remington personnel. Several monorail system manufacturers and installations are currently being investigated to evaluate equipment and discuss detailed requirements. Formal quote packages will be issued to selected vendors in early October, for both a prototype system to be installed in Wilmington, and a full plant monorail system to be installed in Ilion. In addition, these selected equipment vendors will quote on an Automatic Guided Vehicle System (AGVS) to be economically compared with the proposed monorail system.

The purchase order for the prototype system will be placed in December for delivery in April 1984. The production system will be ordered in the third quarter 1984.

Cutting tool development tests to evaluate tool wear and its effect on part size control are in progress at Wilmington Shops. Concurrently, several potential tool monitoring techniques are also being tested including: spindle deflection, power draw, and cutting force. Additional machining tests utilizing new fixture designs and tooling are scheduled to begin September 26 in Wilmington Shops.

Construction of the prototype CNC machining center is progressing slightly behind the original schedule (four weeks). Equipment demonstration tests are now scheduled for March 1984 with machine delivery to Wilmington expected in April.

Latest production forecasts indicate that only seven CNC machining centers will be required to meet 1988 production schedules versus the original ten machine proposal. An economic analysis of this system based on the new schedules is in progress and will be reviewed for Remington management in October.

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 automatic cutoff machine.

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

The Cincinnati Milacron T-3 robot, the mandrel assembly/stripping machine and the system controller have been delivered to Ilion and installation is in progress. Unfortunately, the recent plant man-power reductions will result in a development delay due to electrician and machinist shortages. Trial and Pilot of this system is scheduled to begin in November.

AUTOMATED FLEXIBLE SUB-ASSEMBLY

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 current plans are to authorize a prototype project for several simple assemblies in 1983 and then later develop a more complex assembly system based on the successful demonstration of the prototype technology.

The following assemblies have been selected for inclusion in the prototype 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 21% on a high spot investment of \$500M.

EDL and Remington personnel are currently developing a Construction Cost Estimate (CCE) for the prototype project and will be complete in October. A detailed economic evaluation will be made at that time.

Detailed program plans and final economics will be presented to the Firearms Modernization Operations Meeting in October. Upon Management approval the prototype project will be submitted for authorization in November.

FLEXIBLE MANUFACTURING SYSTEM - SMALL METAL COMPONENTS

The Firearms Modernization group has initiated development of an FMS for machining small metal components. The objective is to develop the most cost efficient manufacturing system while utilizing as much of the receiver machining technology and

software as possible. Current plans include the demonstration of the critical manufacturing items in a prototype project and then expanding the technology and scope to include full production of all small components. Shotgun breech bolts have been selected for prototype development due to the high volume requirements, a large savings potential, and the similarity to receiver machining.

The initial concept has been developed. The system will utilize CNC multiple spindle machining centers in combination with existing machines. Material handling and machine loading will be handled by a combination of operators, robots and a monorail system.

Engineering Department and Remington personnel are currently developing a Venture Guidance Appraisal (VGA) for both the prototype and production facilities.

Detailed program status and economics will be presented to Remington Management at the Firearms Modernization Meeting in October.

WOOD SHOP MODERNIZATION

Conceptual long range modernization plans for the Wood Shop are currently being developed. Preliminary program status will be presented to Remington Management in October. 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. The machine is fully operational, and has been released to production. Ilion Industrial Engineering will estimate the operating cost savings due to this equipment in November.

2. Rotary Bell Atomizers

Review of the wood finishing area indicated an improvement would result 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.

A dryer has been installed on the main compressed air line and has eliminated the air contamination.

Retesting of the DeVilbiss Rotary Atomizers has begun and initial results look promising. Hanging the fore ends upside down appears to reduce the buildup of finish on the lower part edges. Experimental hangers are being built to make an extended test of this condition. In addition, PE&C is experimenting with new fillers which may improve the fill and pad operation. If the new filler is successful, an experimental lot will be tried using the atomizers, since it has been determined that a poor fill and pad coat significantly affects the spraying quality of the atomizers.

Marshall Labs has supplied Remington with high solids Model III and RKW finishes to be evaluated with the rotary atomizers. Additional tests will be conducted with these finishes in October.

ULTRAVIOLET WOOD FINISHING

Remington is currently investigating the feasibility of utilizing ultraviolet (UV) 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.

Initial base coating tests conducted by Remington personnel at the vendor's facility were favorable utilizing both urethane and polyester finishes.

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.

To develop the technology necessary to implement these new finishing processes, extensive testing and development will be required. To maximize development efficiency and prevent the possibility of this technology being transmitted to our competitors, the FM group is proposing the purchase of a prototype UV curing system. However, before this equipment is purchased, additional testing at the vendor's facility will be conducted to address the following concerns:

- o Are UV finishes safe?
- o Will UV finishes "checker" adequately?
- o Will UV finishes protect stocks adequately?

Both Marshall Labs and Remington personnel will review the additional test results. If the tests prove successful, this investigation will proceed as rapidly as possible.

Remington is currently obtaining non-disclosure agreements from the UV curing vendor before additional tests are scheduled.

WOODWORKING MACHINERY AND SUPPLY SHOW

Remington personnel recently attended the Woodworking Machinery and Supply Show in Los Angeles and have obtained the following information concerning wood processing.

- o Vendor Stock Suppliers
 - Potential contacts were made concerning the purchase of complete and semi-complete gun stocks.
- o Automatic Wood Carving
 - Zuckerman, Heian, and Ekstrom-Carlson indicated recent development work on CNC copy lathes.
 - Manufacturers of CNC routers were not encouraging about the use of routers for carving due to long anticipated cycle times compared to existing mechanical copy lathes.
- o Automatic Wood Sanding
 - No new automatic sanding equipment was observed.
- o Competitor's Process Information
 - U.S. Repeating Arms (U.S.R.A.) and Smith and Wesson have each purchased a Campbell Automation CNC router for inletting. The machine uses two turrets of six spindles each, similar to our Heian inletting machine.
 - H&R is using a Graco robot for spraying finish.
 - Ekstrom-Carlson sold three CNC checkering machines to U.S.R.A. and one to Smith & Wesson. The machines are 444 PMC routers incorporating six spindles each and double fixtured to accommodate off-line loading during machine operation. The cost of machines was quoted to be "about \$500M" with fixturing. Programming of checkering patterns for (U.S.R.A.) was done by A. S. Thomas Inc. for "about \$10M-15M per pattern".

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 plant preparation for installation has begun. Meetings have been scheduled with Plant Systems personnel to discuss software changes and other Phase II requirements. In addition, Phase II informational presentation meetings are being planned for production supervision and wage roll personnel.