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REMINGTON ARMS COMPANY, INC.
FIREARMS PROCESS RESEARCH DIVISION
QUARTERLY PROGRESS REPORT
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RECEIVER FLEXIBLE MANUFACTURING SYSTEM

A \$200M Part II authorization for the prototype project is circulating for approval. These funds will provide a VAX 750 computer to the Engineering Department to continue software development activities for the receiver manufacturing system. This computer will be utilized by Remington upon complete system installation at Ilion.

To aid Basic Data and system development, a plant liason team is currently being formed. This team is composed of plant personnel which will be responsible for system start-up at Ilion. Three members of the proposed five member team have been named to date. The remaining members should be selected in early January.

GFM AUTOMATION

System installation for the first GFM machine is essentially complete and the Safety Office has approved the start-up of the power-on debugging phase.

Trial and pilot operations will begin in January with initial production start-up anticipated for February.

AUTOMATIC FLEXIBLE SUB-ASSEMBLY OF SMALL COMPONENTS

A Unimation Puma 560 robot has recently been ordered with delivery expected by April 1984. In addition, design of the system controller and the assembly work stations is progressing on schedule.

SMALL PARTS FLEXIBLE MANUFACTURING SYSTEM

Remington and EDL engineers are currently defining the optimum CNC machining center performance specifications to aid in the selection of the prototype machine. This machine should be ordered in the first quarter 1984.

WOOD SHOP MODERNIZATION

o ROTARY BELL ATOMIZERS

Recent production scheduling problems have delayed the release of the required fore ends for testing, however, a January test now appears feasible.

o ULTRAVIOLET WOOD FINISHING

Remington has recently received nondisclosure agreements from one of the UV finish suppliers. Recent tests at this

vendor's facility indicate the need for improved adhesion and "blushing" to meet our standards. The vendor is currently working to improve these deficient areas.

o AUTOMATED SANDING

Remington personnel are investigating the technical and economic feasibility of developing automated sanding technology. A research strategy will be developed upon completion of this study.

o WOOD SHOP MATERIAL HANDLING

The Process Research Group recently investigated the economic and technical feasibility of rearranging the Wood Shop to achieve an immediate cost improvement.

Unfortunately, the current economic stake is not large enough to offset the cost of equipment dismantling and rearrangement and this strategy will not be pursued at this time.

o PRESS-FORMED STOCKS - ROBOT LOAD

Potential robots' capabilities have been examined to determine the ease of automating this labor intensive operation and initial results indicate favorable technical and economic feasibility.

o PRESS-FORMED STOCKS - LONG STOCKS

The Process Research Group is beginning to reevaluate the technical and economic feasibility of press-forming long stocks.

SERIAL NUMBER RECORDING SYSTEM (SNRS) - PHASE II

The delivery of the system to Remington has been delayed due to a computer hardware delay experienced by the vendor. The installation is now scheduled in May 1984 with full operation expected by July.

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 by Synder Corp. (Division of Giddings and Lewis) to meet Remington's requirements. A \$1.6 MM prototype project has been approved and will include the development and demonstration of all critical system technology including, the machine and fixturing, tooling and tool support, and the inspection and material handling concepts.

Although the computer communication system required to tie these components together is not considered critical technology, system software development will be the time limiting factor in the installation and start-up of the FMS at Ilion. To minimize the software development time, the Engineering Department recommended purchasing a VAX 750 computer by April 1984 to be installed at Louviers for the computer system development engineers. To fund this purchase, Remington management has chosen to add this computer to the prototype project scope under a Part II authorization. As a result, \$200M has been added to the prototype project for a new total of \$1.8MM. The Part II appropriation request is expected to be authorized by year end.

The prototype four spindle CNC machining center acceptance test at Synder has been rescheduled for the week of April 20, 1984. This new schedule represents approximately a six week delay from the original timing. This delay has been attributed to the vendor requiring additional time to "scrape" the machine ways to Remington's requirements. To insure this new schedule is maintained, Remington and Engineering Department personnel will continue to visit Snyder to visually inspect progress and become familiar with the machine construction.

Cutting tool tests are continuing at EDL to gain information on tool life and cutting accuracy. The following tool conditions are currently being investigated:

- o New Tools
- o Conventional Ground Tools
- o CNC Ground Tools
- o Coated Tools
 - Titanium Nitride
 - Titanium Carbide
 - Chrome/Titanium Nitride

To insure the development of the most cost effective, automated receiver manufacturing system, it is necessary to develop detailed system requirements and basic operating data.

This information (referred to as BASIC DATA) will be the official document upon which the computer communication system and the Commercial Cost Estimate (CCE) is based. Remington and Engineering Department personnel are actively developing the Basic Data.

To aid Basic Data and system development, a plant liason team is currently being formed. This team is composed of plant personnel which will be responsible for system start-up at Ilion and as a result, should have significant input into the system description and design. Three members of the five member liason team have been named to date. The remaining members should be selected in early January.

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 mandrel, and loading and unloading the automatic cutoff machine.

System installation for the first GFM machine is essentially complete and the Safety Office has approved the start-up of the power-on debugging phase.

Trial and pilot operations will begin in January with initial production start-up anticipated for February.

AUTOMATIC FLEXIBLE SUB-ASSEMBLY OF SMALL COMPONENTS

Remington and EDL are developing an automatic assembly system for small firearm components utilizing a programmable assembly robot in combination with an automatic part feeding system.

A prototype system has been authorized, (\$750M - capital) which will provide the equipment necessary to demonstrate the critical automatic assembly technology. The following assemblies have been included in the prototype system development due to their high labor requirements and large volumes: shotgun breech bolts, common triggers, M/100-7 trigger housings and shotgun carriers.

Upon completion of the prototype system development, this equipment will also be utilized in Ilion to assemble the above components on a production basis.

A Unimation Puma 560 robot has recently been ordered for this development, with delivery expected by April 1984. In addition, design of the system controller and the assembly work stations is progressing on schedule.

SMALL PARTS FLEXIBLE MANUFACTURING SYSTEM

Remington and EDL have initiated development of a FMS for machining small metal components. The objective is to develop the most cost effective manufacturing system while utilizing as much of the receiver machining technology and computer software as practical. Current plans include the demonstration of the critical manufacturing items in a prototype project and then expanding this technology and scope to include full production of all small components. Shotgun breech bolts have been selected for initial 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 standard CNC machining centers in combination with special purpose machines to broach, deburr, polish, and wash the parts. Material handling and machine loading will be handled by a combination of operators, robots, and a computer controlled part delivery system. As in the receiver manufacturing system, tool management, scheduling, material handling, and information flow will be computer controlled.

The prototype system Appropriation Request for \$1400M was authorized in November. The following equipment will be purchased in this project:

- o CNC Machining Center
- o Programmable Robot
- o Special Purpose Deburring Machine
- o Inspection Equipment

The specific objectives of this prototype equipment is to demonstrate the critical development items of the proposed manufacturing process including:

- o CNC Machine Performance
- o Inspection Requirements
- o Fixture Design
- o Robot Performance
- o Deburring Process Development

Remington and EDL engineers are currently defining the optimum CNC machining center performance specifications to aid in the selection of the prototype machine. This machine should be ordered in the first quarter 1984.

WOOD SHOP MODERNIZATION

Conceptual long range modernization plans for the Wood Shop are currently being developed. Several key areas have been identified as good cost reduction candidates and are presently being investigated for future modernization projects.

o 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 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 has been unsuccessful due to air contamination and subsequent hardware problems.

These problems have been addressed and the equipment is ready to be retested.

Recent production scheduling problems have delayed the release of the required fore ends for testing, however, a January test now appears feasible.

o ULTRAVIOLET WOOD FINISHING

Remington is also investigating the feasibility of utilizing fast drying, high solids, ultraviolet (UV) finishing on all wood products.

Initial base coat 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.

Remington has recently received nondisclosure agreements from one of the UV finish suppliers. Recent tests at this vendor's facility indicate the need for improved adhesion and "blushing" to meet our standards. The vendor is currently working to improve these deficient areas. Remington will continue to pursue this development with Marshall Lab personnel assistance.

o AUTOMATED SANDING

Automated sanding will significantly reduce the labor required to manufacture wood firearm components. However, no applicable technology has been developed (to date) which achieves the quality and flexibility required by Remington.

Remington personnel are investigating the technical and economic feasibility of developing automated sanding technology. A research strategy will be developed upon completion of the feasibility study.

o WOOD SHOP MATERIAL HANDLING

The present wood shop arrangement is not the optimum process layout for wood component manufacturing. Multiple floors and small cramped aisle areas lead to excessive material handling requirements and the subsequent generation of scrap and rework.

The Process Research Group recently investigated the economic and technical feasibility of rearranging the Wood Shop to achieve an immediate cost improvement.

Unfortunately, the current economic stake is not large enough to offset the cost of equipment dismantling and rearrangement and this strategy will not be pursued at this time.

o PRESS-FORMED STOCKS - ROBOT LOAD

Currently, stocks are manually loaded and unloaded into the press form machines. Since most short stocks are press formed, this appears to be a promising area for automation and could yield a significant cost improvement.

Potential robots' capabilities have been examined to determine the ease of automating this area and initial results indicate favorable technical and economic feasibility.

The development strategy will be complete in January.

o PRESS-FORMED STOCKS - LONG STOCKS

Long stocks are presently hand sanded and result in a high cost, non-uniform product when compared to the press-formed short stocks. Previous attempts to press form long stocks were unsuccessful due to the generation of excessive scrap. This scrap was primarily due to the inletted stocks cracking during the pressing cycle.

Two new developments may now allow the successful development of this process:

- o The checkering pattern can now be cut after the stock is pressed. In the previous development, the checkering pattern was pressed in, as are some of the short stocks now. However, in order to achieve acceptable press checkering, excessive pressures were required and the stocks cracked. Cut checkering may eliminate this problem.
- o It may be possible to inlet a press-formed stock. In the previous development, pressing the weaker inletted stock again led to excessive cracks. Recent tests indicate the technical feasibility of inletting the stocks after press forming which should eliminate the cracking problem. These test stocks will be evaluated in January for wood recovery and color blending ease.

This process will continue to be investigated.

SERIAL NUMBER RECORDING SYSTEM (SNRS) - PHASE II

The SNRS is a computerized information gathering and recording system which will provide Remington with an accurate and efficient method of compiling and analyzing production, warehousing, and shipping data.

Phase I, (currently in operation), records daily production information and serial number data for planning, accounting, and production. Phase II will provide real time inventory and shipping control.

The Phase II project has been approved and plant preparation for installation has begun. This system is currently being designed and built by Computer Identities Inc. (CI). CI is providing a turnkey system which is completely compatible to our current Phase I operation.

The delivery of the system to Remington has been delayed due to a computer hardware delay experienced by CI. The installation is now scheduled in May 1984 with full operation expected by July.