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REMINGTON ARMS COMPANY, INC.
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FLEXIBLE RECEIVER MANUFACTURING SYSTEM

Basic Data for the commercial system, developed jointly by Remington and the Engineering Department is now ready for Ilion Plant Management approval. Copies are also being sent to working groups responsible for generating a new Venture Guidance Appraisal. Current plans require an E5 quality VGA by July 9.

The Snyder four spindle machine runoff/acceptance tests in Detroit have been delayed again and are now expected to be complete by July 6th. The delays resulted from problems with both sub contractor equipment and inadequate assembly procedures. These problems have been corrected and preliminary check-out and final debugging of the machine is now in progress on a two shift basis.

Machine alignment check-out for compliance to our specifications is being witnessed by DuPont personel. Most of the items that have been checked are to specification. However, spindle runout and "Y" axis alignment need to be improved. Also, several elements critical to the success of this operation still need to be demonstrated. These include, load/unload of the fixture mandrel and an 8 hour dry cycle test to prove out the ability to maintain dimensional accuracy over varying ambient temperature conditions. Debugging of the test pattern program, installation of additional chiller capacity to maintain temperature control of the machine and resolution of a sluggish spindle drawbar problem are also being worked on in preparation for the machine acceptance cutting tests.

Machining tests of M/1100 receivers at Snyder are tentatively scheduled to begin immediately after machine acceptance and will require approximately three weeks. All of the cutting tools and holders necessary for these tests are at Snyder. Two fixture mandrels and one set of four "A" fixture subplates are also at Snyder. One of four "B" fixture subplates, currently in build, are expected to be ready by June 29th and the remaining by July 10th. Current production gages will be used to measure the receivers where possible, and will be shipped to Snyder by June 29th.

Potential locations for the Receiver FMS System have been investigated. Due to the height requirements needed to maintain the CNC machining centers, no existing building on site was determined to be adequate without major modification. However, three alternatives were determined to be feasible. Layouts of each of these alternatives have been generated.

The first alternative requires that the roof of building 60 be raised to a height to contain the machining centers and perform required maintenance. Additional roof trusses would be added to allow a ceiling supported monorail system for material handling. The computer area would be located above building 61 (chip house) in a newly constructed second floor. The

load/unload areas and other peripheral equipment needed for the system would be located in buildings 58 and 60.

The second alternative requires construction of a new building to the south of building 66 to contain the CNC machining centers. The computer area, load/unload areas and all other peripheral equipment needed for the system would be located on the south side of building 66.

The third alternative under consideration would place the CNC machining centers in buildings 78 and 80. The floor levels in both buildings must be changed to accommodate the machining centers. The computer area would be located on the first and second floors of building 81 (offices). The fixture load/unload areas will be located in building 75 (old garage). The magazine load/unload area and all other peripheral equipment would be located in building 76-3 and 76-3 annex (Powdered Metal).

Estimates have been generated for two of the three alternatives with regard to rearrangement costs.

The first alternative requires rearranging 385 machines at a cost of \$506M. The third alternative requires rearranging 220 machines at a cost of \$320M. The second alternative requirements are still being determined.

Cost estimates of each alternative with regard to building renovation or construction costs and installation will be generated in Wilmington and are expected within the next few weeks.

SMALL PARTS FMS

Some horizontal machining center quotations have been received. All of them are offering their standard CNC controllers with the machine. The controllers quoted so far will not be capable of FMS operation as is currently defined by our Basic Data.

The option of using Cincinnati-Milacron machines, controllers, and software for the Small Parts FMS has become a viable alternative to GE 2000 - EDL software. This could provide several benefits including one source responsibility, a reduced software expense, and faster system implementation. A final decision is contingent on analysis of the situation as it relates to the Receiver FMS and other modernization plans.

SERIAL NUMBER RECORDING SYSTEM II

System development and software coding are continuing at Computer Identics. Several segments are complete and ready to be tested.

A complete employee training program is being planned for late June and through July. All wage roll and supervision who will use and support the SNRS will be invited to attend a series of training seminars conducted by Process Research personnel. To

help ensure an accurate and efficient SNRS.

Installation is scheduled to begin in August with full system operation achieved by October.

GFM AUTOMATION

Training of a third operator was conducted the week of 5/21. This operator was running the system on third shift, but has since been working primarily on the auto-drill system in bldg. 72-1. Currently, plans are not definite for additional operator training.

System documentation is now being updated at EDL and Ilion to reflect changes made during installation and debugging.

A variety of problems have delayed completion of Trial and Pilot of the #4 GFM system. All but one of the problems have been solved, although others may be identified with extensive system operation. The system appears to be running well at this time. Shorter barrels have yet to be evaluated on the system.

A recent problem that has not been resolved is the bending of M/1100 mandrels. The system was not run the first week of June because of bent mandrels. The mandrel knobs were bending after as few as ten cycles. Because mandrels bent at the knob cannot be repaired, there were not enough mandrels for two days until the Tool Room could modify enough to run. After that, the system was not run until the machine setter could devote some time to troubleshooting the problem. The cause of the problem was not identified, and the system was run on the 9th and 11th. Knobs continued to be bent at an unacceptable rate. Because the cause of this problem was still unidentified, the system was changed over to 870-12-30 barrels on June 13 since M/870 mandrels are much less susceptible to bending. (There were no unusual bending problems while running the first lot of M/1100 barrels, and there is no indication at this time that the bending problems experienced were due to automated handling).

The video taping of the system was completed on 5/23. Alan Berry of the General Services Department will be editing the tape and expects completion by 7/13. The reason for delay is that the part of the tape to be filmed at Bridgeport has just been completed. We will acquire a version of the tape consisting of the #4 GFM automated system only.

The most recent forecasts show that a second GFM system would have 89% burdening. Tentative plans are to automate the #3 GFM group. Work on the layout is in progress.

FLEXIBLE ASSEMBLY SYSTEM

Minor gun design changes which will make automatic assembly more practical continue to be evaluated at Ilion. Initial tests of the "new design" extractor plunger and extractor plunger spring indicated a problem with the plungers. Investigation has shown that the problem was apparently due to improper hardening

of the plungers, rather than the design change.

Detail design of the assembly workstations at EDL is slightly behind schedule due to manpower problems. EDL is developing software for the individual workstations. EDL is still using TX funds for the development of a flexible feed (vision) system capable of feeding parts to the assembly system and plans to demonstrate a prototype in July. A vision system would greatly increase our future flexibility in the development of assembly systems. Recent estimates indicate that a vision system would result in a capital increase of \$62M (to \$800M) on the project.

An evaluation has been completed to determine the economic feasibility of automating the assembly of the following assemblies:

1. M/870-1100 Breech Bolt Assembly
2. Common Trigger Assembly
3. M/870 Carrier Assembly
4. M/1100 Carrier Assembly
5. M/700-7 Trigger Housing Assembly

In each proposal, a robot will be used to assemble each assembly. This robot will receive the components necessary to complete each assembly by several different methods. Each proposal has been based on 1987 (3rd year) costs and volumes.

In the first proposal, the robot receives the necessary components from bowl feeders. An economic analysis indicates that based on an investment of \$738M, a gross annual savings of \$50M and a NROI of 3.4% can be realized. The internal rate of return for this proposal is 11%.

In the second proposal, the robot will receive the necessary components from a flex-feed system that uses vision. An economic analysis indicates that based on an investment of \$800M, a gross annual savings of \$89M and a NROI of 5.6% can be realized. The IRR for this proposal is 13%.

In the third proposal, the robot will receive the necessary components from manually loaded parts magazines. An economic analysis indicates that based on an investment of \$550M, a gross annual savings of \$51M and a NROI of 4.6% can be realized. The IRR for this proposal is 12%.

Several additional proposals are currently under evaluation.

AUTOMATED BIRCH FINISHING

Stain was sprayed on birch long stocks with the rotary atomizers to determine the indexing pattern needed to cover the stock. The bells were reciprocated to cover the entire part. Uneven distribution of the color will need to be corrected with variable speed reciprocation. Further testing will be done when the new stain samples arrive.

Topcoat lacquer was sprayed on stained fore-ends with the bells to determine its sealing capabilities. The parts were too thinly coated so larger nozzles were used in the next tests. The results were much better with the larger nozzles, but mechanical problems distorted the results. These will be resolved before lacquer is sprayed again.

A separate report has been issued on each of these tests. A capacity study of the spray line indicates that an additional electrostatic line is needed to meet future requirements. In-house testing of the bells will help in determining the equipment for that line.

AUTOMATED FORE END SANDING

Hau Welco will visit the plant in early July to review proposed plans for experimental testing to be conducted at Gebruder Hau.

CUT CHECKERING DEVELOPMENT

Trial and Pilot is currently underway for the Model 870 Restyle using the Bostomatic for stocks and CO.RE.MA. for fore ends.

Anticipated completion date is June 22.

LONG STOCK MACHINING

The Heian machine has been repaired and is running production. The program was altered for a period of one week to start-up the spindles once they came into position, afterwhich, the slip rings were inspected for signs of arcing. No signs of arcing were found so the timers to delay power to the brushes were tried. It appears that these timers will eliminate the problems experienced earlier, however, the rings have not been inspected yet.

A partial parts list with pricing has been supplied by Wesflex. A letter and a complete parts list has been sent to Wesflex requesting additional information on parts Remington feels it should stock on plant. If Remington does not receive the information requested, Heian will be contacted directly.

WOOD FINISHING AUTOMATION

The testing of M/1100 and M/870 base coating has successfully been completed. The reformulation of the RKW finish (the addition of 4% butyl cellosolve and 1% Imron) and minor alterations to the flow regulators and fluid tips has increased the controllability of the process and contributed to the overall success. One other fore end (yet to be determined) will be developed before scheduling a RKW trial and pilot run with production. An effort will be made to coordinate PE&C's development of electrostatic base coating with FPR's atomizer development to avoid redundancy.

U.V. finish samples are expected from Red Spot. Samples provided to date have not met Remington's adhesion requirements.

DuPont is licensing vapor curing from an Australian company call Vapocure. This type of finishing system appears to offer the advantages of U.V. curing without the toxic hazards. DuPont will most likely sublicense this technology to another company for wood finish development.