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REMINGTON ARMS COMPANY, INC.

REMINGTON RESEARCH

FOURTH QUARTER PROGRESS REPORT - 1985

DECEMBER 23, 1985

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HIGHLIGHTS

NEW PRODUCTS RESEARCH

HIGHLIGHTS

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HIGHLIGHTS

FIREARMS PROCESS RESEARCH

SHOTGUN DEVELOPMENT

Model 1100 Improvements

This program is aimed at maintaining the Model 1100's position in the market place until its replacement by the New Concept Shotgun. The most significant change is a new gas system which will allow the customer to shoot all field and magnum loads in one gun. A stainless steel magazine tube has been added for improved corrosion resistance. The extractor, firing pin spring, piston and piston seal have been redesigned for improved endurance.

In addition to functional improvements, cosmetic improvements, such as cut checkering, 30-gloss wood finish, and a screw machine magazine cap will be offered on selected specifications. Product introduction of the 12 gauge is scheduled for 1987.

The design package was transmitted to Production in August, and the effort is on schedule for a 1987 product introduction. With Production's knowledge, Research is continuing to look at modifications that will further enhance function beyond the significant improvement already transmitted. These changes will not effect Production's implementation schedule.

Based on the computer simulation of the Model 1100 gas system, test guns with a reduced initial volume, the standard inertia sleeve, and a reduction in the valve seat port diameter have shown faster bolt velocities with 1 oz. target loads. While the bolt velocities with 2 oz. magnum loads also increased, the endurance improvements included in the transmittal package should prevent this from being a concern. Eight new guns are being built. If initial bolt velocity readings verify the previous test guns, these eight will be run through a 4,000 round function and endurance test, which is expected to start on January 6.

Cosmetic improvements to the 20 gauge is scheduled for 1988 introduction. Research is conducting bolt velocity tests to determine if gas system changes are required. Initial testing indicates that a magnum barrel, altered with a second orifice hole, and assembled on a field action provides sufficient bolt velocity to function skeet loads reliably. A ten gun endurance test will be scheduled.

Model 870 Improvements

Similar to the Model 1100 Improvement program, this item is designed to maintain the Model 870's position in the marketplace until its replacement by the New Concept Shotgun. Major improvements include a new rivetless ejector system made up of a Delrin® base and an Injectalloy® rod, revised camming angles on the action bars and shell latches to provide smoother motion, improved shell latch staking, and a two-piece firing pin spring for better endurance. Introduction is scheduled for 1987.

Research's design verification testing is complete. Program goals set for ejection improvement and reduction of the action opening/closing forces have been met. Specifically, the test showed:

- the malfunction rate (from the three field function tests included in the design verification test) was 0.13% for the Improvement Guns versus 0.74% for standard Model 870 control guns.
- no parts breakage (4,000 rounds per gun) of improvement items.
- perceived opening and closing forces during shoulder shooting was significantly less on the Improvement Guns.
- no problems with the Model 1100 Special Field - type magazine cap detent system.
- No unstaking of the feed latches.

The parts lists and drawings packages were transmitted to Production on December 5.

Shotgun Choke Tubes - 20 Gauge

Choke Tubes are inserts which thread into the muzzle of the barrel. They allow shooters to change choke constriction without having to change the entire barrel assembly. 12 Gauge choke tubes are included on several specifications, in both the Model 870 and Model 1100, for 1986. 20 gauge choke tubes are scheduled for introduction in 1987.

Increasing the wall thickness of a Model 1100-20 gauge barrel to accommodate choke tubes, and carrying that extra wall thickness rearward until it intercepts the current breech taper causes an interference with the fore-end barrel groove. To allow retrofittability, either a reverse-tapered barrel or a barrel swelled on the end to accommodate the choke tube is required. Samples of both are being built for testing and Business Team review. This is not a problem on the Model 870 12 gauge.

New Concept Shotgun

The Model 870 and Model 1100 have been in the line since 1950 and 1963 respectively. This program will replace both of those models, probably in the early 1990's, with new products that will utilize state-of-the-art technology and materials. While this is principally a shotgun program, developments coming out of it are expected to also be implemented into centerfire and rimfire rifles.

PDS encountered dimensional problems with the trigger plates supplied by Remington. They are now machining new trigger plates using the hammer pin hole as the datum. Two prototypes of the indirect firing mechanism are expected in Research in mid-January. Wear durability of the magnetic iron to be used in the sear needs to be verified. Research will machine and heat treat prototypes, and dry cycle through 100,000 cycles.

A scaled-down version of the direct firing mechanism for use with a rotary bolt locking system is being developed.

Drawing modifications to change a wood stock and fore-end to synthetics were more extensive than originally thought. This has resulted in a delay in sending the drawings out for quotes. The drawings should now be complete in early January.

An air damper system built into a Model 1100 has been tested with encouraging results. Average terminal bolt velocities with a 3 in., 1 7/8 oz. shell were reduced approximately 25% to 308 in/sec. The test was stopped after 10 rounds because the link deformed, verifying the efficiency of the air damping.

Parker Shotgun

The Parker is considered to be one of the finest side-by-side shotguns ever produced. Originally made by Parker Brothers, a Meridan, Connecticut firm founded in 1868, it was later manufactured by Remington, when Remington purchased the firm in 1934. Remington ceased production of the Parker in 1947. Consideration is now being given to marketing a limited number of Parkers that would have the look and feel of the original guns, but would be updated to meet current design standards. Research has decided to modify the proven Model 3200 fire control for assembly to the Parker frame. Kolar Arms, Racine, Wisconsin, is working under contract to Remington to make the design modifications.

Kolar is on schedule. A modified Parker should be available for test in early January.

RIFLE DEVELOPMENT

New Bolt Action Rifle

A new bolt action rifle is being developed as a replacement for the Model 700 BDL. Introduction is scheduled for 1988. Technical improvements include a safety to block both the sear and trigger, a detachable magazine box, a revised extractor, an independent bolt lock, and integral scope mounts.

The engineering test rifles are being assembled. Receivers were delivered on December 5 and are in the Custom Shop for assembly, chambering, and final heading. Magazine boxes are behind schedule from the stamping vendor. They are now promised for Christmas week.

Research and Marketing took part in six focus panels held in Seattle, Kansas City, and Dallas during the week of December 9. These panels were very important towards telling us how the customer wants the rifle styled.

XP-100 in 223 Caliber

The XP-100 is Remington's target and hunting pistol. The 223 caliber is a new offering scheduled for mid-1986 introduction. Research transmitted the parts list and drawings package to Production on October 31.

Six XP-100's were provided for the Writers Seminar in November, in McAllen, Texas. Reports from attendees of that meeting said they were very well received.

Model 700 in 338 Win. Mag. Caliber

This addition of a new caliber to the Model 700 line is scheduled for 1987 introduction.

Design acceptance testing is complete. The parts list and drawings package have been transmitted to Production.

Receiver Flexible Manufacturing System

Cincinnati Milicron has quoted a number of software system enhancements. A layout for the tool area has been completed using CM software. The November 1 software quote from CM for advanced tool kit planning was on time, but has been sent back for further revisions.

The ejector cut for the M/870 Restyle is being studied and considered for the FMS. To date the shotgun receivers have been given development priority for the T-10.

Downtime on the T-10 still remains a problem. Testing at EDL will continue to evaluate the integrity of the N.C. programs, and establish valid tool life data. ESD's Applied Statistics group has been asked to supply a consultant to help interpret tool life/tool wear data and propose a program to determine machine compensation offsets.

Small Parts Flexible Manufacturing System

The single part, "A" load, CNC program for M/870 breech bolts has been completed. A single part, "B" load, CNC program for M/870 breech bolts has been completed and run without tools in the holders. A four part program used to simulate the thirty-two part program has been complete but not tested. The "B" load and four part programs were scheduled to be tested in November. Due to unscheduled downtime on the T-10 this testing has been rescheduled for January 86.

CNC programming for the M/1100 breech bolt has been started, many subroutines from the M/870 breech bolt will be used. The M/1100 CNC program should be ready for testing by mid January. Locking block CNC program development will follow the M/1100 breech bolt.

Shotgun Barrel Automation

A meeting was held at EDL with Dr. Howard Kuhn of Deformation Control Technology (DCT), a consulting firm, to discuss the use of DCT as a consultant in evaluating forming technologies for use in shotgun barrel manufacture. This was followed with a plant visit by Dr. Lynn Ferguson, also of DCT, to review our current manufacturing process and to discuss in detail our shotgun barrel requirements. A proposal from DCT describing their plan for evaluating current technology for application to shotgun barrel forming and for evaluating our current process for improvements is due by the first week in January, 1986.

A final report from Harold Hameister reviewing past experimental work in shotgun barrel manufacture was received. This report identified two promising processes to achieve the desired "No turn, No-Ream" shotgun barrel. These processes are the "Modified Rockrite Process" and the "Two Stage - Warm Extrude, Coin and Sink Process". Evaluation of these two processes is continuing independently and simultaneously with the above described consultant work.

Common Length Shotgun Barrel

PE&C has issued to Industrial Engineering Section an official estimate for the capital costs to the plant to produce a common length (30") shotgun barrels through most of the current process. This estimate is under the high spot estimate that was completed last month by this section. Industrial Engineering will do an economic evaluation based on these costs. Their estimate should compare favorably with the evaluation that was done last month. The study indicated that this revised process will yield $200M in incremental earnings from avoided lost sales and $915M reduction in work in process inventories. PE&C has also indicated that it will run a test lot of barrels (1000) to determine if the cutting off of barrels further in the process has any effect on barrel concentricity.

A composite cycle has been developed for a Model 1100 shotgun barrel to be processed from the beginning of the line to the end of the line. This cycle time is based on machine cycles and operator time. A composite cycle time for the Model 870 shotgun barrel is underway. These times will be used in evaluating new processes for shotgun barrel processing.

Flexible Small Parts Assembly System

Orbitally riveted M/700 trigger housings with chamfered rivets and spacers have been tested and found acceptable, but no design transmittal will be granted at this time. Research has asked that 25 additional assemblies, made as loose as possible, be tested to verify process sensitivity. If testing shows that performance criteria are compromised with the loose assemblies, a method for 100% inspection of rivet tightness will be required to use the orbital riveting process. Loose assemblies for test are currently being manufactured in the plant.

A production quantity of "new design" connector pins has been ordered from the standard pin vendor. They will be shipped by February 1986. The pin design will then be tested for transmittal along with other trigger assembly modifications.

A 20ma current loop DECnet communications link is being installed between the microVAX and the Research VAX/750. Once the link is brought up, source code can be stored and compiled in Ilion.

S.O.P.'s for the system and operator training are being written. Once the initial draft is completed, they will be submitted to production and the safety office for review.

At EDL, work continues on the development and debugging of the breech bolt workstation and second assembly robot. EDL technicians are currently teaching robot motion paths. Because of developmental problems, the workstation and second assembly cell will not be delivered to Ilion until mid-1Q'86.

#3 GFM Automation

The Strip/Assemble machine at EDL has been tested in local mode and no major problems were encountered. All equipment (stripper, control cabinets, and gripper) was shipped 12/12/85 and will arrive 12/16/85.

The American Induction Heating Co. solid state controller was received 12/6/85.

A sample lot of blanks was sent to Campbell the week of 12/1/85 for prove out of the blank feeding unit. Delivery will probably now be 1B/85 to 2A/85.

Cut Checkering

870 Restyle production using the Bostomatic and CoReMa is now running on three shifts.

A Dico bench type polishing and buffing lathe has been ordered to better facilitate cleaning of the checkered area. An existing wire brush will be add-used for this operation. The Dico unit is expected to arrive at any time.

Another cutter designed and made by Ekstrom Carlson was shipped with out latest checkering machine acquisition from Mossberg (the S&W Ekstrom Carlson machine). The first shift operator has tried them on the CoReMa (Fore-end/hand sanded) with a resulting longer tool life. This cutter has three cutting lips of a straight gashed geometry. The cutters we were using also have three lips but are of a spiral gashed geometry. The spiral gashed cutter seems to perform much better on the Bostomatic (Stock/pressed form).

Diamond cutters on order from Accurate Dia. Tool Corp., are expected at any time.

A satisfactory program has been developed and tested for the Model 1100 Restyle stock on the Bostomatic. Programming for this machine takes about a tenth of the time it would have for the multi-head DuPont/Rem special machine.

Form Rolling Development

Rol-Flo, Inc., has been able to successfully warm-roll what appears to be a sound shotgun firing pin from our 3-Step 8620 machined blanks. They will run a few more samples along with the Injectalloy ® blanks, and send them to us for our evaluation. This will complete their initial contract for the first phase of this warm-rolling development.

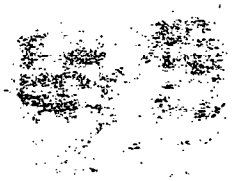
The next phase would be to continue under a new contract with Rol-Flo, with tooling to finish the point and the rest of this part to its current as purchased geometry. This phase will be contingent on the provision of a formed blank. Most heading companies that have been recently contacted about this part have expressed little doubt in the 3-step blank, and some think a near net shape may be possible.

Form Rolling Development - Contd.

One such company is Kalt Mfg. They have been asked to provide an estimate to make samples of both the 3-step blank and near net finished part. Other companies will also be considered.

Another approach to forming this part from a seamless tube is also being evaluated.

WHColeman,II:js



RESEARCH PERSONNEL AS OF DECEMBER 31, 1985

FIREARMS

Exempt 23	Non/Exempt 11	Wage Roll 12
Bauman, Thomas G.	Frost, Helen B.	Baggetta, Joseph A.
Bower, James W.	Jones, Raymond A.	Bedworth, Gary R.
Calkins, Kevin L.	Miller, Steven M.	Butler, Richard G.
Coleman, Wm., H., II	Pickett, Wm., F.	Fiorentino, Dominick
Curry, Wm.	Saunders, Susan P.	Harter, James D.
Douglas, Terry C.	Schuster, Joyce M.	Howe, Robert
Ericson, Wm., L.	Smithson, Ronald L.	Kozakowski, Robert
Findlay, David S.	Stephens, Charles J.	McManus, Owen
Franz, Scott R.	Supry, Fred	Starks, Gerry
Hand, Charles J.	Urtz, Donald J.	Truax, Irving E.
Hennings, James H.	Webster, Ronald A.	Williams, Clifford
Hugick, Adam H.		Williams, Donald
Hutton, James C.		
Martin, Fred E.		
Martin, James S., Jr.		
Murphy, Randall S.		
Plunkett, Thomas J.		
Powers, Thomas P.		
Rankins, Edwin		
Rowlands, Kenneth C.		
Sanzo, Robert J.		
Saunders, Eugene L.		
Snedeker, James R.		

Total Firearms Personnel - 46

AMMUNITION

Exempt 2	Non/Exempt 1	Wage Roll 2
Cole, Wm., T.	Thomas, Dennis	Dunn, Timothy
Smith, Floyd H.		Selan, Jerry

Total Ammunition Personnel - 5

FIREARMS PROCESS RESEARCH

Exempt 6	Non/Exempt 2	Wage Roll 0
Baszczuk, Andrew R.	Klock, Edward A.	
Leonard, Peter J.	Perry, Celia M.	
Owens, Edwin R.		
Poarch, Calvin A.		
Ritchie, C. Evan		
Shumway, Daniel W.		

Total Firearms Process Research Personnel - 8

* ESD Engineer - Firearms - James Ronkainen
* ESD Engineers - Firearms Process - Gordon R. Chetosky
John A. McClary

REMINGTON PERSONNEL

Remington Roll

	Actual 12/31/85
Exempt	
Ammunition Research	2
Firearms Research	23
Firearms Process Research	6
Total Exempt	31
Non/Exempt	
Ammunition Research	1
Firearms Research	11
Firearms Modernization	2
Total Exempt	14
Wage Roll	
Ammunition Research	2
Firearms Research	12
Total Wage Roll	14
Total Research	59