

LIMITED DISTRIBUTION

REMINGTON ARMS COMPANY, INC.

RESEARCH DEPARTMENT

FIRST QUARTER PROGRESS REPORT - 1984

DISTRIBUTION

F & FP - Remington Arms

J. P. McAndrews	M. M. Coburn
B. A. Beardwood	<u>W. H. Coleman, II</u>
E. F. Barrett	C. B. Workman
R. A. Darby	D. M. Condon
E. Hooton, Jr.	R. B. Gordon
G. L. Ehrens	P. S. Hebert
R. A. Partnoy	R. J. Iverson - Lake City
C. T. Wagner	C. A. Riley

Other Departments

R. C. Forney	Administrative
H. E. Simmons	Central Research & Development
A. MacLachlan	Central Research & Development
W. T. Alumkal	Central Research & Development
R. G. Bennett	Polymer Products
H. S. Eleuterio	Petrochemicals
J. P. Glas	Chemicals & Pigments
W. C. Govier	Biomedical Products
R. M. Harbour	Atomic Energy Division
S. E. Isakoff	Engineering
R. K. Quisenberry	Central Research & Development
D. B. Rogers	Photosystems & Elec. Products
K. A. Saegbarth	Agricultural Chemicals
M. L. Sharrah	Conoco
D. S. Weir	Textile Fibers

NOTE: Please destroy this report when it has served your needs.

HighlightsFirearms ResearchPage No.New Shotgun Products

- Acceptance testing of 12 gauge Model 1100 Special Field trial and pilot guns has encountered insufficient bolt velocities. 4
- Research has concluded its program on the Model 870 Special Field by approving production samples. 4
- Final specifications for the Model 870 Restyle have been agreed to and design data transmitted to Production. 4
- Testing of Briley choke tubes has shown them to perform satisfactorily. 4
- Long-range product development emphasis has shifted from bolt action rifles to autoloading shotguns. A three-phase program to upgrade and eventually replace the Model 1100 is underway. 4

New Rifle Products

- Computer Aided Design (CAD) modeling of the Model 700 Mountain Rifle stock is progressing on schedule. Accuracy testing of model guns is complete. 5

Current Arms

- Testing of the flexi-tab carrier in the Model 870P Riot Gun has shown this to be a satisfactory solution to the jamming problem. 5
- The folding stock on the Model 870P shotgun has been redesigned in response to field complaints. 5

Research Department

-1-

March 1984

HighlightsFirearms Process ModernizationPage No.Receiver Manufacturing System

- A rough draft of project basic data has been received. Demonstration tests of the prototype machine in the vendor's plant have been delayed until early May. Test N/C programming and tooling are in hand.

6

Small Parts Manufacturing

- Specifications for the commercial machining center that forms the core of this system will be released for quotation in early April.

6

Barrel Forming (GFM) Automation

- The robot based loading system for the first GFM complex is in routine operation. Improvements to cycle time and hot barrel cut-off are proceeding.

6

Wood Finishing Automation

- Testing of the DeVilbiss rotary bell atomizers continues. Results to date are encouraging, but are still not satisfactory for production.

7

Automated Fore-End Sanding

- Machine sanding tests conducted at 3M indicate that complete fore-end sanding is not feasible with commercial equipment. Modifications to existing machines are being considered.

7

Ammunition ResearchGeneral

- The consolidation of Firearms and Ammunition Research at Ilion will be complete in August.

8

Research Department

-2-

March 1984

HighlightsShotshell ProgramsPage. No.

- Rotary cam 12 gauge 2-3/4" product and 20 gauge 2-3/4" rifled slugs are being warehoused. 8 gauge AH&P tool design is being confirmed in hand headed product. 28 ga. body former tool trim-in is in process. 8
- "Premier" magnum shotshell ballistics are unacceptable at extreme storage conditions. Faster powders and lighter pellet primers yield more favorable ballistics. Sample powders are being evaluated. 10
- Remington Target Load requirements have been established. Extensive field tests in blue bodies will begin in early 1985 using rotary cam bodies, 209 primer, RTL wad, and brass caps. 10

Centerfire Programs

- Hand-formed, secant-ogive, flat-base .30 caliber bullets have outperformed Sierra's boattail bullet in down-range ballistics. Mush is still inconsistent. Machine formed bullets are being evaluated. Chemical polishing yields much improved case appearance. 11

FIREARMS RESEARCH

- Model 1100 Special Field Shotgun

The Model 1100 Special Field was introduced in 1983 to offer the shooter a lighter weight, faster pointing Model 1100, with a shortened barrel, a slimmed down fore-end, and an English style stock. Cracking of the wooden fore-end on the 12 gauge model has delayed production of this gun. Research acceptance testing of trial and pilot samples have been delayed due to insufficient bolt velocities. Barrel port diameters have been adjusted and testing resumed.

- Model 870 Special Field Shotgun

This shotgun was introduced in 1984 as a complement to the M1100 Special Field, with similar appearance and performance features. Research has approved both the 12 and 20 gauge trial and pilot production guns. Production to the warehouse has begun on both shotguns. This concludes the Research effort.

- Model 870 Restyle

This 1985 product is being developed to enhance the visual quality and appearance of the 870 pump gun. Specifications include cut checkering, medium gloss finish, and 3" chambering. The 12 gauge parts list and drawings package have been transmitted to production. Samples and drawings for 20, 28, and .410 gauges (all planned for 1986 introduction) have been started.

- Choke Tube Development

A screw-in choke tube system is being developed to offer shooters the convenience of a variable choke barrel to adapt to different hunting situations. One option is to offer tubes manufactured by Briley Manufacturing, Houston, Texas. Briley choke tubes have been tested and approved by Research. Remington designed tubes are scheduled to be tested by June, 1984. Production will determine comparative costs for manufacturing Briley and Remington choke tubes, either in Ilion or by outside sourcing.

- Model 1100 Replacement

We have begun a three-phase effort to upgrade the existing performance and quality, and eventually replace the Model 1100 with a gun that will sustain our market share into the 1990's. Research into the performance of the Model 1100 is almost

Research Department

-4-

March 1984

complete. This has pinpointed four areas for improvement that will be the focus of Phase I. They are:

- carrier assembly
- action smoothness
- gas system
- component endurance

The second phase of the program will be a restyling of the external features of the gun to be introduced in 1986. The last phase will be the introduction of a new generation autoloading shotgun by 1989.

• Model 700 Mountain Rifle

The Mountain Rifle will be a large caliber, bolt-action gun aimed at the upper end of the market. It is scheduled for a mid-1985 introduction as a replacement for the Model 700 Classic. Testing of model guns is complete with good results. CAD modeling of the stock is progressing on schedule. An economic evaluation is being prepared.

• Model 870P Jamming

The possibility exists for a shell to jam between the carrier and slide assembly, making the Model 870P shotgun very difficult to open. Research has developed modifications to the slide, breech bolt, and carrier that eliminate this problem. One gun with the proposed changes has been cycled over 100,000 times with no problems. A second carrier was cyclically loaded to simulate a jam. The carrier broke at approximately 12,000 jam cycles. An additional 100 carriers have been received from the stamping vendor. After processing, 50 will be made available to Marketing for field testing. The remainder will undergo additional testing in Research.

• Model 870P Folding Stock

Complaints have been received from the Ohio State Police that, in sub-freezing temperatures, the folding stock on the Model 870P becomes inoperable. We determined that the clearance between the stock and pivot pin was insufficient to compensate for the different coefficients of expansion. The pivot pin has been redesigned, and a quantity will be made available to the Ohio State Police for retrofitting in their Model 870P shotguns with folding stocks.

Research Department

-5-

March 1984

FIREARMS PROCESS MODERNIZATION• Receiver Manufacturing System

The Engineering Department has submitted a rough draft of the production project basic data to Ilion for review. A layout of the Receiver FMS in building 60 has been generated on the Intergraph CAD system at Louviers that shows the load/unload areas utilizing monorail track spurs. These spurs allow a higher degree of flexibility than previous designs and should reduce the cost of the load/unload stations. Further revisions to this layout will be necessary as the system becomes more refined.

The Snyder machine runoff/acceptance tests have been delayed approximately one month. Most of the problems have been with subvendor components including incorrect drive axis motors, an additional voltage limiting transformer requirement, and revisions to the GE executive software. Acceptance tests at Snyder are now scheduled to begin in late April with Model 1100 receiver machining tests following in early May. The N/C program that will be used to demonstrate machine acceptance has been prepared at EDL and checked out at GE. All of the cutting tools needed to demonstrate receiver machining at Snyder are expected to be shipped to Detroit by mid-April.

• Small Parts Manufacturing

Specifications for the machining center to be purchased as part of the Small Parts FMS prototype project are nearly complete. EDL has reviewed and revised them based on their experience with the receiver machine. The specifications will be completed and delivered to Purchasing in early April for vendor quotations. Ongoing discussions are underway to assure computer control and manufacturing process compatability between the receiver and small parts systems.

• GFM Automation

All equipment has been installed and the system is now producing parts automatically at a cycle time of 1 minute 44 seconds versus a goal of 1 minute 30 seconds. Because the robot waits for the GFM to complete its cycle, the critical element for cycle time is the speed with which the robot can unload and load

the GFM. Cutting off hot barrels has presented several unexpected problems:

- tool wear: the life of standard (high-speed steel) saw blades was reduced by 90% to an unacceptable level; carbide blades are now being tested
- metal shrinkage: a hot barrel will shrink almost 0.1" after it is cut off; this can be compensated for because it is repeatable when the system cycles continuously
- runout: the muzzle end cut is not square with the barrel, apparently due to shrinkage during the cut

Although the capital project anticipated automation of two GFM systems, there are no definite plans to proceed with the second system. It would only be burdened 14% in 1985 based on three-shift operation at current forecast levels.

• Wood Finishing Automation

Tests are continuing on the Devilbiss rotary atomizers. A third test was run which utilized the operating ranges developed from the previous two. In this test, fore-ends were only indexed four times rather than continuously. Results were good overall, but further development is required. The first and last part of a group attracts more finish than the middle parts. Thus, parts were sprayed in groups of three with the part of interest in the middle. It was discovered that a group of parts larger than three appears to spray much better. Future tests will be run with larger groups of parts.

Devilbiss and Du Pont's Marshall Labs were contacted to obtain additional information to help eliminate the minor problems that are being encountered. It was suggested to try adding a different solvent to the RKW in an effort to get better spraying results.

• Automated Fore-End Sanding

In conjunction with Foster Miller, Inc.'s proposal for a fore-end sanding machine, tests were conducted at the 3M Coated Abrasives Methods Center in St. Paul, Minnesota. Several basic concepts were tested. These included rough machining of the exterior shape from a blank as well as finish sanding of a rough contoured piece. The basic tests were performed on a slack belt molding sander. The forms for contouring the sanding belt to the

desired shape were made of birch with the desired profile machined in them. The tests showed that the majority of a fore-end can be sanded with belts, but complete sanding of all fore-ends is probably infeasible on this machine. Rough economics and alternate ideas are being developed to determine if there is a process which can be developed utilizing the Foster Miller concept that would allow complete sanding of a fore-end.

AMMUNITION RESEARCH

• Research Consolidation

A project is underway to consolidate Bridgeport Ammunition Research with Firearms Research at Ilion. It is anticipated the project will be completed in August, 1984, with the transfer of all personnel. General construction layout has been approved and a purchase order issued to prepare bid packages. Layout details are completed and are in the final stages of review. Some minor changes are required to accommodate the differences in firearms and ammunition needs. A generalized exit plan for Bridgeport Research has been prepared and preliminary work begun. The vast majority of hazardous materials have been properly disposed of. Screening and consolidating files and the Research Library are well underway.

• Rotary Cam Body Forming Process

The Rotary Cam Process is being developed to provide a single process for all shotshell gauges. It has been designed to substantially increase process tolerances and yield, and simultaneously improve product quality. Status of the gauges yet to be commercialized are:

8 Gauge

Cap movement was observed at 150° in machine headed product due to gas leakage around the primer. No other product casualties have been found at any test temperature. Modifications to heading pins and cavity punches have been successfully evaluated in a small sample. Larger samples of hand-headed, hand-loaded product are currently being prepared for testing at all temperatures.

Research Department

-8-

March 1984

10 Gauge

A tapered shell is currently being designed to eliminate problems encountered in forming small straight primer bores. The advantage of the tapered shell is that a thinner bridge can be made while maintaining internal volume, thus easing the problem of forming the primer bore. Initial samples will be ready for load development in late April.

12 Gauge 2-3/4"

Modifications to AH&P heading stems to correct domed heads and primer movement have been successfully evaluated and are being used by Production on a continuous basis. Modifications to the body forming prehead punch have eliminated corner tears in the base section. Continued testing of product by ballistics has confirmed earlier results with no casualties reported. All work on this body is complete.

20 Gauge

The 20 gauge rifled slug load passed all product acceptance tests. The product is currently being warehoused.

20 Gauge Target

Smooth bodies for target loads are being produced in Bridgeport and shipped to Lonoke for processing. Samples were headed, loaded, and submitted for product evaluation. Testing to date indicates that improvements are needed in the heading operation.

A high incidence of crimp and body splits was observed on product shot at -20°F. Inspection of the loaded rounds indicates these splits are due to severe crimping forces. Standard trim and skive tools were used on the loader which resulted in higher crimping forces to form and close the crimps. In addition, a check of the storage temperature revealed temperatures of -30°F to -40°F which may have aggravated the splitting problem.

28 Gauge

Tool trim-in on the production body former is progressing. Bodies are dimensionally correct. Since there is no AH&P capacity for 28 gauge remaining in Bridgeport, current plans are to produce bodies, hand head and load using brass caps to demonstrate the product.

.410 Bore

Testing of 2-1/2" .410 bodies has been promising. Reloading life is considerably better than that of the plant-produced bodies, and function and casualty in severe guns show no heading defects. Problems of "rim bursts" previously seen on the 3" shell have not been seen with 2-1/2" product. Slug production continues to be a major problem. Wall variation cannot be held within acceptance limits ($\pm .003$). A new controller has been installed on the extruder.

- "Premier" Shotshell

Hercules propellants used in all magnum "Premier" (buffered and/or copper plated shot) shotshells have demonstrated unacceptable ballistics sensitivity to environmental storage conditions due to large changes in powder moisture content. An attempt is being made to develop alternate powder sources while investigating the possible causes for the sensitivity of Hercules powder. Five powder manufacturers have been sent components for use in powder development. They are:

Bofors (Sweden)
 Kimera-Oy (Finland)
 Expro (Canada)
 Olin (Florida)
 Hercules (New Jersey)

Sample powders have been received from Kimera-Oy, Olin, and Hercules. Preliminary indications show a faster powder with a lighter pellet primer yields improved ballistics and reduced sensitivity to storage conditions.

- Remington Target Loads

A Remington Target Load will be introduced in all target gauges during the summer of 1985. Previous to the formal introduction, extensive field testing of the products in blue bodies is planned. The technical elements for all target gauges have been determined and are as follows:

- Smooth, green Rotary Cam bodies (yellow in 20 gauge)
- #209 Primer (reduced pellet weight in .410)
- New RTL wad (12 gauge only)
- Brass caps (including .410 and 28 gauge)

A critical item in the required Research program is the new wad. Based on a Marketing request, the candidate wad was

originally designed for the component trade and features a flared shot pouch for ease of reloading. However, as a factory loaded component, the wad will present considerable feeding problems. Redesign of the pouch section to minimize the flare will reduce these feeding difficulties.

• "Premier" Centerfire

Competitive centerfire rifle products with superior ballistics, accuracy, and cosmetics have gained acceptance among hunters. Marketing has requested a similar line of products to maintain our position. 200 yard accuracy and ballistic coefficient testing of hand-formed, 30 caliber, secant-ogive bullets have been conducted in Lonoke with the following results:

	200 yd. Accuracy <u>3/5 Shot Groups</u>	Ballistic Coefficient	
		<u>Predicted</u>	<u>Actual</u>
Control 180 gr. PSPCL	2.6"	.383	.362
180 gr. Flat Base Secant	1.6"	.488	.484

The predicted ballistic coefficients agree well with actual values. The secant-ogive flat base bullet outperformed Sierra's 180 grain Spitzer boattail bullet (ballistic coefficient .462) tested in June, 1983.

Mush of hand-formed secant-ogive bullets into gelatin was inconsistent. Hand forming requires the use of unannealed jackets which inhibit good mush. Samples with nose cuts performed well. Further testing will take place with machine formed bullets.

Samples of chemically polished centerfire brass cases have been produced with an exceptionally bright surface finish. Samples had metal removal rates of .2 gm/case. Measurement of the case wall indicates a reduction in thickness of .008", which is insignificant. High spot economics indicate an incremental net return of 75% on a permanent investment of \$700M for bullet gauges required for the new bullet profile, bullet burnishing, and case polishing equipment.

R. E. Fielitz/dr

Research Department

-11-

March 1984

RESEARCH PERSONNELRemington Roll

	<u>Actual</u> <u>2/29/84</u>	<u>Actual</u> <u>3/31/84</u>	<u>Fcst.</u> <u>12/31/84</u>
<u>Exempt</u>			
Ammunition Research	9	9	8
Firearms Research	27	28	33
Firearms Modernization	10	10	9
Administration	<u>1</u>	<u>1</u>	<u>1</u>
Total Exempt	47	48	51
<u>Non-Exempt</u>			
Ammunition Research	11	10	6
Firearms Research	10	11	12
Firearms Modernization	1	1	1
ER&DD	1	1	0
Administration	<u>1</u>	<u>1</u>	<u>1</u>
Total Non-Exempt	24	24	20
<u>Wage Roll</u>			
Firearms Research	16	16	17
Firearms Modernization	<u>1</u>	<u>1</u>	<u>1</u>
Total Wage Roll	17	17	18
Total Research Dept.	88	89	89