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REMINGTON ARMS COMPANY, INC.

NEW PRODUCTS RESEARCH

THIRD QUARTER PROGRESS REPORT -- 1984

SEPTEMBER 28, 1984

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HighlightsFirearms ResearchPage No.New Shotgun Products

- Development and testing of automatically compensating gas systems for the Model 1100 functional improvement are progressing. Initial testing of a manually compensating system looks very good. 1
- Revised specifications for the Model 1100 Restyle will be supplied to Production this month. 1
- Members of Remington Research and the Du Pont Engineering Department participated in a creative problem solving session on the New Concept Shotgun. 2
- Design and testing of the Remington Choke Tube System is complete. Drawings have been transmitted to Production. 2
- A drawings package and parts list are being prepared showing the revised specifications for the Model 870 Restyle. 2
- Research has approved Production's trial and pilot sample of the Sportsman 12 Auto. 3
- Drawings have been transmitted for the Model 1100 Special Field Ducks Unlimited offering. 3

HighlightsFirearms ResearchPage No.New Rifle Products

- The Model 700 Mountain Rifle project has been approved. 3
- The Sportsman 78 in .243 and .308 calibers has been transmitted to Production. 3
- New bolt action rifle prototypes will be evaluated in December. 3
- The Model 700 Ducks Unlimited offering has been transmitted to Production. 4

Ammunition ResearchGeneral

- Ranges and office facilities are complete at Ilion. Exempt personnel moves to Ilion are complete. Shutdown of the Bridgeport, CT. facilities and transfer and/or termination of excess personnel will be completely by 11/1/84. Project capital expenditures are at 90% with transfer and installation of semi-works equipment the only major expenditures remaining to be completed. 4

Shotshell Products

- A Rotary Cam Task Force has been proposed to assist Production in startup of existing products and complete remaining product development at Lonoke. Personnel assignments, project schedules and key assumptions have been detailed and are being reviewed by Department Heads. 12 GA. and 20 GA. products are currently in production. 8 GA. and 28 GA. tooling have been trimmed in the production machine. .410 bore tooling has been fabricated for the production machine. 10 GA. and 16 GA. tooling is being developed. 4,5

HighlightsAmmunition ResearchPage No.Shotshell Products - Contd.

- A "Premier" Shotshell Task Force has been formed to: 1) develop an alternate two piece body product and process; 2) continue development of an alternate load system in the Rotary Cam large volume body; 3) improve component weight control at loading; and 4) develop a method to charge lower density shot buffers. 6,7,8
- Remington Target Load 12 Ga. rotary cam bodies have been made on the production machine and passed all product test in Research using the new Remington 209 primer and RTL wad. The critical path item is the new RTL wad. Key issues needing resolution are: 24 cavity mold cycle time; -20°F wad breakup on vendor produced samples; and, wad feeding at loading. 8

Centerfire Products

- "Premier" centerfire bullets have been made on the bullet assembly machine in Lonoke with a significant improvement in the ballistic coefficient (+16%). Mush performance was inconsistent due to the small amount of exposed lead. New forming dies and jacket draw punches are being fabricated to improve the ballistic coefficient and mush. 9

Firearms Research

- Model 1100 Functional Improvements

The Model 1100 is the most popular autoloading shotgun ever built. Since its introduction in 1963, over three million guns have been sold. This program is aimed at maintaining the Model 1100's position in the marketplace until its replacement by the New Concept Shotgun. Improvements have been concentrated in the areas of gas system design, action smoothness, feeding, and component endurance life.

Initial testing of both the friction break and elastomer seal options for an automatically compensating gas system were favorable. Sensitivity tests, to measure the effects of lubrication, heat, powder residue, and wear, indicate that further development of both designs is required. A leaf spring valve venting concept is in the Model Shop and testing will begin in October. If a manually compensating gas system remains a backup alternative, initial testing of a reversible piston looks very good.

Areas of the fire control, action bar, and locking system are being investigated to improve action smoothness. The energy spike noted when the locking block disengages can be significantly reduced by changing the camming of the locking block on the barrel extension. The economic feasibility of doing this is being investigated. Changes to the disconnect camming angle significantly reduces the energy needed to cam this component. Other changes to the action bar such as plating, and reducing the bearing surface, do not seem to cause much change. Changes to the hammer spring force cannot be made because insufficient firing pin indents result. Changes to the hammer contour do not result in significant improvements.

Revised carriers to improve feeding should be received from the stamping vendor by the end of September.

- Model 1100 Restyle

The cosmetic changes in this program are designed to complement the functional improvements being made to the Model 1100. Specifications include cut checkering, 30-gloss wood finish, two-piece butt plate, screw machine magazine cap, and choke tubes. Introduction of 12 gauge specifications is scheduled for 1986.

Research Department

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September, 1984

- Model 1100 Restyle - Contd.

Revised specifications and a parts list will be supplied to Production this month to begin project economics.

- New Concept Shotgun

The Model 1100 was introduced in 1963 and immediately became the industry standard for autoloading shotguns. However, few significant changes have been made since then, while competition has blunted our technological advantage. This program, which is designed to replace the Model 1100, will reestablish Remington as the innovator and technical leader in autoloading shotguns.

An engineering review of state-of-the-art autoloading shotguns has been completed.

A creative problem solving session was held at the Remington Farms on September 10 and 11 to generate ideas for new technology that may fit into this program. Selected members of Remington Research and the Du Pont Engineering Department participated.

The Research Plan will be issued by the end of September.

- Choke Tube Development

Choke tubes offer customers the ability to interchange chokes in the field to meet varying shooting opportunities. Introduction of Remington choke tubes is scheduled for mid-year 1985, in the Model 870 Restyle.

Design of the Remington choke tube system is complete and has been transmitted to Production. Pattern testing was acceptable.

- Model 870 Restyle

This cosmetic program is designed to keep the Model 870 competitive. Changes to the current model include choke tubes, a new recoil pad, 30-gloss wood finish, an ivory bead front sight, and cut checkering. Introduction of the 12 gauge is now scheduled for mid-year 1985.

The specification changes made in late August require new economics. A drawings package and parts list are being prepared.

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September, 1984

- Sportsman 12 Auto

The Sportsman series of shotguns and rifles focuses on the economy market. Functionally, these guns are comparable to our regular line, but the metal and wood finishes have been reduced. The Sportsman 12 Auto is scheduled for introduction in 1985.

Research has approved Production's trial and pilot sample, and released Production to put product in the warehouse.

- Model 1100 Special Field - Ducks Unlimited

A dinner gun is being offered to Ducks Unlimited which will be the Model 1100 Special Field (12 Ga.) plus B-grade wood, a game scene etched on the receiver side panel, and a 26" barrel with Briley choke tubes.

Drawings have been transmitted to Production.

- Model 700 Mountain Rifle

Scheduled for 1986 introduction, the Mountain Rifle will address the higher end of the bolt action rifle line and replace the Model 700 Classic.

The project has been approved, and a Process Engineering master schedule has been developed. N/C Shop fabrication of the Stock former is continuing in an effort to meet the trial and pilot schedule.

- Sportsman 78 - .243 and .308 Calibers

With the addition of these two short-action calibers in 1985, the Sportsman 78 will offer a complete line to the cost conscious shooter.

The parts list and drawings package have been transmitted to Production.

- New Bolt Action Rifle

A new bolt action rifle is being developed as a potential replacement for the Model 700, possibly in 1988. Technical improvements over the Model 700, include enhanced safety, reduced locktime, a claw-type extractor, and an independent bolt lock.

Engineering prototypes are being built for evaluation in December. Computervision modeling of components is being done on a safety-critical priority basis.

Research Department

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- Model 700 Ducks Unlimited

For 1985, Remington will produce a special, limited production Ducks Unlimited dinner rifle. Since the variations from the standard Model 700 entail only cosmetic changes, the total Research involvement will be limited to the transmittal and trial and pilot evaluation.

The parts list and drawings package have been transmitted to Production.

AMMUNITION

- General

Research Consolidation

Ammunition and Firearms Research have been consolidated at Ilion, New York.

Range and office facilities are complete at Ilion. 85% of the Bridgeport R&D Semi-works, handloading equipment, office furniture, and files have been shipped to Ilion. The Test Lab furniture, test equipment and armory will be shipped to Ilion in late October. The remaining semi-works equipment will be shipped after development of the SP thin wall plastic basewad product and new RTL wad experimental run is complete.

Exempt personnel moves to Ilion are complete. The remaining exempt personnel will vacate the research facilities in Bdpt. by 11/1/84.

All Bdpt. non/exempt personnel will be off the Research roles by 11/1/84 through VTI or transfer to wage role in the Bridgeport plant.

- Shotshell Products

New Unibody Process

The New Unibody Shotshell 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.

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September, 1984

o Product Implementation Plan

A Task Force has been proposed to conduct and coordinate the completion of product development and assist in start-up of existing new unibody shotshell products at Lonoke. The Task Force consist of three research and three to four process engineering personnel lead by a Lonoke coordinator. Personnel assignments, project timing and key assumptions have been outlined and are being reviewed by department heads.

o 12 Ga. 2 3/4"

135,000 blue smooths target bodies have been produced on the production body former. Redesigned extrusion, prehead and sizing punches were used to thin the wall taper .004" per side. This change eliminated the cosmetically unacceptable bulge just above the target brass cap. In all function and casualty and handloading (standard and severe) test this body proved superior to the PTL control and at least equivalent to Winchester's AA body. All tooling to produce these bodies has been given to Production.

These bodies have been sent to Lonoke to be loaded as the new Remington Target load using the R209 primer and new RTL wad. The loading run will be conducted as soon as the loading machines are checked out (in progress), bowl feeding problems using the new wad are resolved and the 209 primers are manufactured (awaiting anvil brass).

o 28 Ga. 2 3/4"

Tooling for three stations have been trimmed in on Quadrant One. 56,000 bodies were run. A limited quantity was run on two stations due to body feed and heatset equipment problems. Lonoke has been notified of these problems.

Differences in the bridge height up to .010 was observed between stations. This is similar to the differences observed on 8 Ga. product run of this Quadrant and suspect its due to flexing of the prehead striker rod plate. These plates have been redesigned and Lonoke has been made aware of the problem. The technical data package and tooling has been sent to Production.

o .410 Bore

3" & 2 1/2" Product from the R&D body former in severe function and casualty testing was equivalent to control. Tooling for the production body former has been fabricated, inspected and delivered to Production. Tool trim-in on the production body former did not occur due to conflicts with production and consolidation schedules. A preliminary data package is being prepared for transmittal to Lonoke by the end of September.

• "Premier" Shotshell

Competitive shotshell products with buffered and/or hard copper plated shot have acceptance among upland game and waterfowl hunters. Marketing has requested a similar line of products to maintain our competitive position.

o 12 Ga. 3" 1 7/8 oz.

For over a year an intensive R&D effort has been directed at developing this load in the rotary cam large volume (RCLV) body using Remington components and available and experimental powders. Many problems have arisen and have been resolved but two still remain; 150°F pressures at or slightly above 15,000 psi and pressure growth at -20°F (possibly due to grain fracturing). Because of this R&D conducted a series of tests to determine why Federal's equivalent load did not have this problem. In summary below are our observations:

- The RCLV body increases pressures ~ 1900 psi over Federal's plastic thin wallpaper base wad body.
- Remington's shot buffer (Gulf) increases pressures 1500 psi over Federal's buffer (Microthene).
- The RCLV body has 4% less volume than Federal's body.
- Higher component weight variation was observed in Remington versus Federal factory loaded product.

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September, 1984

• "Premier" Shotshell - Contd.

o 12 Ga. 3" 1 7/8 oz. - Contd.

A three part concurrent program has been outlined and personnel assignments made to develop and implement solutions to these problems. They are:

Part I S.D. Wildman	Develop SP thin wall plastic basewad process as an alternate body. R&D to assist in load development.
Part II R&D	Develop an alternate load system for the RCLV body.
Part III AWG Ervine Process Eng.	A - Adjust and repair as necessary the loader charges to improve weight variation. B - Determine what is needed to charge Federal's buffer.

Details of the above programs are described in the following paragraphs:

Part I We found that the SP thin wall plastic basewad yields nearly equivalent ballistics to Federal's body when using all the Federal components. S.D. Wildman has been assigned responsibility to develop the process for making and assembling this body. R&D will assume load development responsibility.

Part II R&D has also found that using Federal's buffer in the RCLV body gives us the opportunity to use faster powders. These powders require lower charge weights which let us use larger cushion wads. R&D is pursuing the development of this load in the RCLV body.

Designed experiments using Expro's 8662 powder and Gulf buffer in the RCLV body indicates acceptable ballistics should be obtained if component weights are held within reasonable limits as defined by the Bridgeport plant. Although pressure growth still occurs at -20°F, a second small run is planned at Lonoke after the machine is checked out to verify R&D predictions.

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Part III Previous plant loading runs were analyzed for component weights. We found large variations in buffer weights and a bimodal distribution for powder weight. We suspect this contributed significantly to the unacceptable high pressures observed using Expro's 8662 powder. AWG Ervine and Lonoke Process Engineering have been asked to check out, set up and replace worn parts on the chargers prior to startup.

• Other "Premier" Shotshell Loads

12 Ga. 3" 1 5/8 oz., 20 Ga. 3" 1 1/4 oz. and 20 Ga. 2 3/4" 1 1/8 oz. load development will begin in early October after R&D equipment is in place at Ilion.

• Remington Target Load

Marketing has determined a need to introduce a new line of target loads (RTL) to enhance our competitive position. This new load would consist of the new unibody shotshell, R209 Primer, brass caps in all gauges and new wad in 12 Ga.

The new unibody has been manufactured and tested with excellent results. It is superior to the PTL in function and casualty and re-loading tests (See Exhibit I). In addition it is superior to the Federal Gold Medal and equivalent to the Winchester AA in both standard and severe reloading test (See Exhibit II)

The R209 primer has been demonstrated in extensive field test to surpass the existing 117 primer in sensitivity and piercing resistance and equivalent to it in ballistics performance. Lonoke is awaiting receipt of anvil brass to start manufacturing these primers. Plans are to use these primers now in all existing target loads.

Brass caps already exist for 12 and 20 Ga's. & .410 bore brass caps have been developed. .410 bore caps exhibited a low frequency of splits at cupping. Tooling changes will be investigated as project assignments allow.

The critical path element of the RTL program is the new 12 Ga. wad. Key issues are:

- 24 cavity mold cycle time
- Wad breakup of initial component wad
Sample from the vendor
- Wad feeding at loading
- Economics

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- Remington Target Load

Attempts to run the new 24 cavity mold at the vendors (Automatic Injection Molding, Inc.) plant at the 8-9 seconds goal have not been successful. Cycle times were 14 seconds resulting in a 46% cost increase over AIM's original price quote of \$6.75/M given in December 1983. The vendor now maintains that unforeseen ambient conditions (high humidity) at their plant site does not permit the use of chilled water for mold cooling due to severe condensation problems on the tooling. Also, product samples molded at fast cycles show considerable fin distortion which may be due to inconsistent temperature conditions within the mold. Another problem with the vendor-produced wads is -20°F base section break-up which may be due to a thin base section. Their wad base was .020" (30% less) thinner than the one produced by R&D. This occurred because of tolerance buildup on an unspecified dimension.

Efforts will continue to modify the mold for reliable operation at low cycle times and to thicken the base section and regain the low temperature performance demonstrated in single cavity molded wads.

An alternative is to continue using the RXP wad which performs satisfactory under most target shooting conditions, however this would not achieve the low cost objective for component wad sales.

Lonoke has conducted test and found the new wad feeds at about 60% of the RXP wad feed rates. Process Engineering and R&D concluded new feed bowls will be required.

- "Premier" Centerfire

A second trial run of .30 cal. secant ogive bullets was made on the prototype bullet assembly machine in Lonoke. A 16% improvement in ballistic coef. over current product (.457 vs. .385) and a 12% improvement in retained energy at 400 yds. can be realized with these bullets.

Meplats of .070" dia. were produced. To achieve the ballistic coef. goal of .482, a meplat of .050" is required. An additional ogive forming die has been made to more fully form the bullet before the final form station.

With little exposed lead, satisfactory mush is difficult to achieve. Hand nose cuts were put on the bullets and mush performance met project goals. Three nose cut dies and one profiled nose cut k.o. punch have been designed to produce nose cuts during bullet assembly. The model shop in Ilion has started work. Also, design of a longer .30 cal. jacket with a mouth to help promote mush is complete and jacket draw punches are expected

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September, 1984

• "Premier" Centerfire - Contd.

to be fabricated by early October. When ready these punches will be used by EDL to fabricate progressive draw jackets for the third trial run in Lonoke. The increased jacket length facilitates 180 grain desired core weight and prevents lead core weepage at the nose.

W.H. Coleman, II:js

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TABLE I
RELOADING RESULTS
RTL (R.C.) vs PTL
With Various Component Wads

STANDARD RELOAD

SAMPLE BODY	WAD COLUMN	1ST FAILURE	LAST FAILURE	RELOADING LIFE	BF INDEX	BCO INDEX
RC	RTL	22	26	23.8	0	0
PTL	RTL	13	23	18.5	21	0
RC	PT12	21	26	24.2	0	0
PTL	PT12	19	23	20.7	2	0
RC	RXP	25	30	27.5	0	0
PTL	RXP	21	24	22.2	0	0

SEVERE RELOAD

RC	RTL	13	16	14.3	57	0
PTL	RTL	8	10	9.3	107	62
RC	PT12	15	18	16.5	35	0
PTL	PT12	8	10	8.9	111	99
RC	RXP	14	16	15.1	49	9
PTL	RXP	10	13	11.2	88	70

TABLE II

RELOADING RESULTSVARIOUS BODIES RELOADED
WITH WIN. AA TARGET WADSSTANDARD RELOAD

BODY	1st FAILURE	LAST FAILURE	RELOADING LIFE	BF INDEX	BCO INDEX
WIN. AA	16	22	20.0	7	0
FED GOLD MEDAL	15	17	15.5	45	4
PTL	11	22	16.1	41	0
RC	17	25	22.4	3	0

SEVERE RELOAD

WIN. AA	10	16	13.0	70	0
FED GOLD MEDAL	7	15	10.5	95	51
PTL	6	7	6.3	137	95
RC	12	14	13.1	69	31

RESEARCH PERSONNEL AS OF SEPTEMBER 30, 1984FIREARMSExempt 27Non/Exempt 13Wage Roll 17

Balaska, Robert J.
 Bauman, Thomas G.
 Bower, James W.
 Calkins, Kevin L.
 Coleman, Wm., H., II
 Curry, Wm.
 Findlay, David S.
 Franz, Scott R.
 Hand, Charles J.
 Hennings, James H.
 Hugick, Adam H.
 Hutton, James H.
 Kast, Jack L.
 Lawrence, Jeffrey A.
 Martin, Fred E.
 Murphy, Randall A.
 Nightingale, Richard
 Plunkett, Thomas J.
 Powers, Thomas P.
 Rankins, Edwin D.
 Rowlands, Kenneth
 Sanzo, Robert J.
 Sassone, Richard L.
 Saunders, Eugene L.
 Smith, Robert
 Snedeker, James R.
 Yetter, Edward W., Jr.

Eskoff, Sophie
 Jones, Raymond A.
 Martin, James S., Jr.
 Pickett, Wm., F.
 Saunders, Susan P.
 Schuster, Joyce M.
 Smith, Floyd H.
 Smithson, Ronald
 Stephens, Charles
 Supry, Fred
 Thomas, Dennis
 Urtz, Donald
 Weaver, Harold

Baggetta, Joseph A.
 Beader, Robert
 Bedworth, Gary R.
 Butler, Richard G.
 Dunn, Timothy
 Fiorentino, Dominick
 Harter, James D.
 Howe, Robert W.
 Jennings, Dale E.
 Kozakowski, Robert J.
 Paslak, W., F.
 Sohns, Wm., A.
 Storne, Ramon
 Truax, Irving E., Jr.
 Williams, Clifford
 Williams, Donald
 Williams, Ronald R.

Total Firearms Personnel - 57

AMMUNITIONExempt 9Non/Exempt 3Wage Roll 0

Cole, Wm., T.
 desJardins, C.F., Jr.
 Dwyer, John M.
 Garrett, Thelma B.
 McDonald, Daniel A.
 Peterkin, Vinton A.
 Simpson, Wm., R
 Sroka, Lee R.
 Tomek, Warren L.

Buccitti, Dominick C.
 Champine, Barry M.
 Raimundo, John A.

Total Ammunition Personnel - 12

RESEARCH PERSONNELRemington Roll

	<u>Actual</u> <u>9/30/84</u>	<u>Actual</u> <u>10/31/84</u>	<u>Fcst.</u> <u>12/31/84</u>
<u>Exempt</u>			
Ammunition Research	9	7	7
Firearms Research	27	27	29
Firearms Modernization	9	9	9
Administration	<u>1</u>	<u>1</u>	<u>1</u>
Total Exempt	46	44	46
 <u>Non/Exempt</u>			
Ammunition Research	3	3	3
Firearms Research	13	14	14
Firearms Modernization	1	1	1
Administration	<u>1</u>	<u>1</u>	<u>1</u>
Total Non/Exempt	18	19	19
 <u>Wage Roll</u>			
Ammunition Research	-	-	3
Firearms Research	17	18	18
Firearms Modernization	<u>1</u>	<u>1</u>	<u>1</u>
Total Wage Roll	18	19	22
 Total Research Dept.	82	82	87