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RESEARCH AND DEVELOPMENT - FIREARMS
THIRD QUARTER PROGRESS REPORT - 1982
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Remington Arms Company, Inc.

- 2 -

HIGHLIGHTS

<u>NEW PRODUCT DEVELOPMENT</u>	<u>Page</u>
● All six XSG prototype shotguns have been completed and are being test fired to document function and endurance. An estimate of factory cost to produce the base case design is being prepared.	5
● Prototype Model 1100 12 Ga. Special - Field shotguns have been reviewed and approved by Management. Parts and drawings are being completed for testing and transmittal.	6
● A joint program has been initiated with Ammunitions Research to develop electric ignition firearms and ammunition for sporting applications. Initial development will concentrate on shotgun applications.	7
● Prototype Model Four carbines have been fabricated for review by Marketing personnel, including one lightweight design featuring an aluminum receiver. Initial development will include a .223 caliber carbine for introduction in 1983.	7
● Design is in progress on three different prototype bolt action rifles for replacement of the Model 700 BDL in 1985. Completion of prototype rifles has been delayed until February.	8
<u>CURRENT PRODUCT DEVELOPMENT</u>	
● Model Seven Lightweight Rifles in 7mm-08 caliber are being assembled for the 1982 Remington Gun Writers' Seminar in November. Production expects to complete trial and pilot of the .308 caliber by October 1.	8

- 3 -

	<u>Page</u>
● Model 700 ADL Restyle is being tested with long action stamped no-bind followers. Three 30-06 caliber rifles have been completed for the Writers' Seminar.	9
● Model 700 Classic .300 H&H Magnum model drawings have been transmitted. This rifle will be a special offering for 1983.	10
● Model 700 BDL .223 Rem. tested with satisfactory results.	10
● Model 870 Limited Edition etched receivers have been received and are being evaluated.	10
● Model 1100/870 Left Hand Deer Guns have been satisfactorily tested.	10
● Model 870 Magnum full choke Police shotguns have been completed for testing in October.	11
● Model 1100/870 - 20 Gauge Lightweight shotguns with modified choke barrels do not meet pattern density specifications. Competitive barrels are being shot to compare results.	11
● Model 870 trial and pilot 1982 Ducks Unlimited Commemorative and Special Dinner Models have been inspected and accepted. Warehousing of these two models began in June. Trade Model trial and pilot guns will be ready for inspection in November and warehousing to begin in December.	11
● Model 1100 prototype models of the 1983 Ducks Unlimited Commemorative guns have been completed and furnished to Marketing.	11

<u>MATERIALS AND PROCESS DEVELOPMENT</u>	<u>Page</u>
● Development of a process for stainless steel components is receiving top priority in the injection molding program. The Parmatech equipment should be operational in October.	13
● A CNC machine has been identified which will meet all of the goals of the cut checkering machine development program. An Italian machine has been identified which also looks promising.	14
● A pilot run will be made during the week of September 20 to burnish shotgun firing pins by form-rolling.	14
● A fourth set of powder metal samples has been shipped for cryogenic processing by an external vendor.	15
● Research is in progress to investigate coatings to reduce corrosion of monel stainless steel powder metal parts.	15
● A master plan has been developed for automating the gallery and final inspection. EPL will submit a proposal for 100% inspection of critical components.	16

- 5 -

STATUS - NEW PRODUCT DEVELOPMENTXSG/XPG Shotguns

New autoloading (XSG) and slide action (XPG) shotguns are being developed as potential replacements for the M/1100's and M/870's, respectively. Objectives include decreased weight, increased reliability, and reduced manufacturing costs.

All six XSG prototype shotguns have been completed and test fired to a combined total of 31,000 Magnum rounds. Testing is being done to establish endurance levels for these contingency designs. These six prototypes were fabricated to provide information on design alternatives for locking, feed, and action systems.

The projected minimum capital investment required to implement an XSG design into production has been reduced by 30% to approximately \$3.5MM. That total includes approximately \$1MM each for implementation of a new locking system, a new receiver design, and cut checkering, plus \$500M in miscellaneous items. A factory cost estimate for this revised design is scheduled to be completed in October.

Other design alternatives being considered include use of an aluminum receiver and styling revisions to produce a distinctively different appearance. Aluminum receivers will provide further weight reduction by approximately one pound compared to the current steel receiver design. Prototypes with aluminum receivers have performed satisfactorily for up to 8,000 Magnum rounds with no significant damage to the receiver.

- 6 -

Model 870/1100 12 Ga. and LT-20 Special Shotguns

The Model 1100 Special is being developed to offer the shooter a lighter weight (7½ lb), faster pointing M/1100 with a significant change in appearance. This model is intended to supplement the current Model 1100 line. As currently defined, the gun features a 21" barrel, a slimmed down and shortened fore-end, English stock, cut checkering, medium gloss finish, and no scroll marking. Introduction of the Model 1100 Special - Field in 12 and 20 Ga. is planned for 1983. Extension to Deer and Waterfowl Model 1100's and a complementary series in the Model 870 is planned for 1984 through 1986.

A prototype of the Model 1100 Special - Field, 12 Ga. has been completed and approved by Management. Additional prototypes are being prepared for function testing. Model drawings are being completed for Design Transmittal in October.

Parker Shotguns

Remington purchased the Parker Co. in 1934 and produced the Parker side-by-side shotgun through about 1942. These fine double barrel firearms have become collector items and the Parker name still enjoys an excellent reputation for quality. Re-introduction of the Parker side-by-side in very limited quantity is planned for 1983 to provide a direct indication of consumer interest in these firearms. These guns will duplicate the original Parker's in every detail. If dictated by market demand, further production will be planned beyond 1983.

- 7 -

Model requirements have been established and design drawings will be prepared based on existing, unused Parker components. Two model guns will be completed by the end of December.

Electric Ignition Shotgun

A joint development program has been initiated with Ammunitions Research to develop electric ignition firearms and ammunition for sporting applications. Initial development will concentrate on shotgun applications and will provide the basis for a new generation of sporting firearms. Use of electric ignition will provide advantages in cost, safety, design simplification, and styling flexibility. Preliminary studies will employ the existing electric primer used in the Remington 8 Ga. Industrial Gun. However, long range development will concentrate on a primer and fire control design which can be used in both shotgun and centerfire rifle applications. Introduction of the first generation shotgun is scheduled for 1986.

Model 7400 and Model 7600 Centerfire Rifles

The Model 7400 and 7600 rifles were developed as replacements for the Model 742 and 760, respectively, and were introduced into the product line in 1981. The Plant experienced a variety of start-up problems which have required continuing Research support. Furthermore, new calibers and carbine versions are being developed for future introduction.

Model 7400 Research prototypes in 25-06 and 7mm-08 calibers have been function tested. Test results were satisfactory. Introduction of these new calibers is planned for 1984.

- 8 -

Prototype Model Four carbines have been fabricated for review by Marketing personnel, including one design featuring an aluminum receiver which reduces overall gun weight by 12 ounces. Initial development will include a .223 caliber carbine for introduction in 1983. Currently, feeding of the .223 cartridge is the primary design uncertainty. Magazine box development for improved feeding is in progress.

Bolt Action Rifles

The objective of this program is to design a bolt action rifle to replace the Model 700 BDL. Major features incorporated into the new design include an octagonal receiver, "diamond finish" barrel, and a restyled stock.

Three different prototype rifles are being developed to illustrate design options including revisions to receiver contour, stock shape, feed system, safety, and fire control. Completion of prototype rifles, including custom stock and receiver designs by Bob Emmons, has been delayed until February. The third sample from Emmons, which will feature revisions to the stock to facilitate high volume production and modifications to the receiver, has been delayed and will not be received until October.

STATUS - CURRENT PRODUCT DEVELOPMENT

Model Seven Lightweight

The Model Seven Lightweight is a short, light weight, bolt action, center-fire carbine rifle, developed to replace the Model 600, discontinued in 1979. It will be strategically placed within the Model 700 product line.

- 9 -

Forty Model Seven Lightweight Rifles in 7mm-08 caliber are being built for the 1982 Remington Gun Writers' Seminar in November. Eighteen have been completed. Twenty-two are in the process of having stocks checkered and final accuracy tested. The forty guns will be shipped from Ilion on October 1, along with 4,000 rounds of ammunition.

Production is running a trial and pilot of the Model Seven Lightweight in .308 caliber. Expected completion date is October.

New .222 caliber follower springs are expected in October. Tests will be run with new no-bind followers and the current followers.

Model 700 ADL Restyle

The Model 700 Restyle is an upgraded ADL version which will feature improved wood and metal finishes.

Prototype ADL long action no-bind stamped followers, with the original design formed spring stop surfaces to prevent shifting of the magazine spring, were tested using the current production magazine spring. Feeding from the magazine was satisfactory and only one gun showed a slight shifting of the magazine spring. An endurance test is being run on this gun to determine the total amount of magazine spring movement.

Experimental short action .222 Rem. no-bind stamped followers and new magazine springs have been ordered. Testing is scheduled to begin the first of November.

Three long action 30-06 caliber rifles for the Writers' Seminar have been tested and are ready to be shipped.

- 10 -

The parts list and all model drawings, except for the stock, checkering, and .222 Rem. short action magazine follower drawings, have been transmitted.

Model 700 Classic in .300 H&H Magnum Caliber

The .300 H&H Magnum caliber will be a non-catalog item offered on a one-time basis for 1983. Parts list and model drawings have been transmitted.

Model 700 BDL in .223 Rem. Caliber

The .223 Rem. Caliber was initially brought out as a varmint caliber in the BDL. It will be offered with the standard BDL barrel contour in 1983.

Accuracy and function testing was completed with satisfactory results. The parts list and model drawings have been transmitted.

Model 870 Limited Edition

Scheduled for 1984 introduction, this special high grade Model 870 shotgun will commemorate the 75th anniversary of Remington's first slide action shotgun, the Model 10, introduced in 1907.

First sample etched, gold plated, uncolored receivers have been received from Fountain Plating, Springfield Massachusetts. Three of the six receivers have been colored. Two colored receivers have been sent to Marketing for their evaluation. New samples with needed corrections will be ordered when Research and Marketing have completed their evaluations.

Model 1100/870 Left Hand Deer Gun

Marketing has had requests over the years for a left handed model. They have asked that it be added to the shotgun line in 1983.

- 11 -

Models have been made and tested. Drawings and parts lists have been transmitted to the plant.

Model 870 Magnum Full Choke Police Shotgun

Marketing has requested this gun in 12 Ga. 3" Magnum, full choke, 18" plain barrel, and Parkerized finish to be added to the line in 1984.

Barrels have been completed and will be tested in October.

Model 1100/870 - 20 Ga. Lightweight with Mod Choke Barrels

Marketing has requested that 20 Ga. lightweight shotguns with 3" Magnum chamber in 28", vent rib, modified choke barrels be added to the line in 1983.

Barrels have been tested in the Model 1100 and 870. Patterning tests do not meet our specifications. New ammunition and competitive barrels have been secured to compare results. Testing will be completed in September.

Model 870 Ducks Unlimited Shotguns - 1982

1982 is the second year of a four year program to furnish special shotguns to the Ducks Unlimited Organization. The following list of guns will be produced this year:

- Model 870 - 12 Ga. - 3" Magnum - Commemorative Dinner Gun
- Model 870 - 12 Ga. - Lightweight - Special Dinner Gun
- Model 870 - 12 Ga. - 3" Magnum (32" Barrel) - Trade Gun

Commemorative and Special trial and pilot models have been inspected and accepted. Warehousing of these models began in June. Revised panel roll markings for the Trade Model have been completed. Two models of the Trade

- 12 -

gun were made at Marketing's request in mid-August. One model was used for photographs for the 1983 catalog and the second model will be viewed at the Remington Writers' Seminar in November. The Trade Model trial and pilot guns will be ready for inspection in November, and warehousing to begin in December.

Model 1100 Ducks Unlimited Shotguns - 1983

1983 will be the third year of a four year program to furnish special shotguns to the Ducks Unlimited Organization. The following guns will be produced for 1983:

- Model 1100 - 12 Ga. - 30" Full Vent Rib Barrel - Commemorative Dinner Gun
- Model 1100 - LT-20 LTD - 23" Modified Vent Rib Barrel (Short Stock) Special Dinner Gun
- Model 1100 - 12 Ga. - 26" Full Vent Rib Barrel - Trade Gun

One prototype model of each gun has been furnished to Marketing. Parts lists and drawings have been furnished to Process Engineering and manufacturing costs have been established. Final economics were presented at the September Operations Committee Meeting.

Warehousing of the Commemorative and Special Dinner Guns is scheduled for July, 1983. The Trade Model will be warehoused in October, 1983.

- 13 -

STATUS - MATERIALS AND PROCESS DEVELOPMENTInjection Molding of Metal and Ceramic Components

Injection molding is a technique for producing intricate, three dimensional shapes in metals and ceramics. Remington has purchased a license from Parmatech Corporation and is developing the process for external commercial sales and internal production of firearms parts.

Installation of the solvent extraction stills will be complete by the end of the month, coinciding with the anticipated receipt of the Parmatech debinderizing oven.

Stainless steel development is receiving priority. One acceptable run of Wittec premixed 316 stainless was made earlier in the month, but a second run to verify the results proved unsatisfactory. Wittec uses an elemental mix which may not be possible with stainless. Parmatech 316, stainless blended using prealloyed powders, will be run in early October, as will a Remington mix, again using prealloyed powder.

Additional alloy development is progressing. A higher strength Ni-Fe (100,000 psi tensile range) and Kovar (Fe-40% Ni) have been processed. Properties of both materials must be verified.

Johnson and Johnson has inquired about a development program for injection molding ceramic and stainless steel orthodontic appliances. Norton has responded negatively to our proposal for injection molding their technical grade ceramics. Norton feels that they would reveal too much proprietary information.

- 14 -

Cut Checkering

Contrary to most competitors, Remington currently cut checkers only its higher grade guns, using press checkering, or no checkering, for the majority of the product line. The goal of this program is to develop a cut checkering system capable of producing acceptable quality at a lower price than our present N/C machines.

A Bostomatic CNC has been demonstrated satisfactorily for press formed stocks, and will be reviewed for fore-ends. This machine meets all of the project goals.

CO.RE.MA. (Italy) has supplied a sample from a new type of machine. The quality appeared very good, and the price is well below CNC machines.

A project will be submitted in the 4Q82 to purchase a prototype machine. Early project approval will provide equipment for checkering development, and production capability for the M/1100 Special.

Form Rolling

Form rolling is a deformation process, similar to thread rolling, which may be applicable to manufacturing solid cylindrical parts such as firing pins. Initial development work is being done jointly with Rol-Flo Engineering, Inc., West Kingston, Rhode Island. The successful application of form rolling to make trigger plate pins has been demonstrated. Form roll burnishing of shotgun firing pins has been selected as a second application.

- 15 -

Initial samples of form roll burnished shotgun firing pins look good. A Process Development engineer will visit Roll-Flo Engineering this month for a pilot run. Both soft and heat treated firing pins will be tried.

Cryogenic Processing of Powder Metal Parts

This process involves slow cooling of the parts to about -320°F and holding for approximately 24 hours. Significant improvements in properties for wrought parts are claimed. This has been verified for high nickel powder metal alloys, where results have consistently surpassed the goal of 200,000 psi tensile strength.

A fourth set of samples has been provided to an external vendor for cryogenic processing. This group includes samples that were sintered in a vacuum, and in a dissociated ammonia atmosphere.

Corrosion Reduction of Monel and Stainless Steel Powder Metal Parts

After a lengthy testing period, corrosion of monel and stainless steel parts has been traced to free iron contaminant in incoming powders. This has now been confirmed by the vendor. The degree of iron contamination varies from lot-to-lot.

Of all the slugs tested (Monel, 316L, 316LSC, and 830), the 316LSC appears to be the most corrosion resistant. Even this material shows some corrosion after 2 - 3 days in salt water.

An immediate solution to the corrosion problem appears to be the use of coatings. Several contacts have been made to provide coatings of various forms. Research is continuing.

-16 -

Testing and Inspection

Three major areas are being investigated — 100% inspection of critical components, automation of the gallery, and automation of final inspection. The goal of all of these programs is to improve product quality and reliability while simultaneously reducing unit costs.

A master plan for automating the gallery and final inspection has been formulated, consisting of five basic elements: the gun jack, fixturing, scanning, functioning equipment, and a computer control.

EPL was visited on September 14 to discuss various requirements for 100% inspection of critical components. They will submit a proposal by the end of October.