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RESEARCH AND DEVELOPMENT - FIREARMS
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Remington Arms Company, Inc.

HIGHLIGHTSPageNEW PRODUCT DEVELOPMENT

- Six (6) different prototype autoloading shotguns have been completed and test fired to a combined total of 43,000 Magnum rounds. 3
- Five (5) 12 Gauge samples and one 20 Gauge sample of the Model 1100 Special Field shotgun have been completed for display at sporting trade shows. 4
- Prototypes of a Model 7400 Carbine in .223 caliber have been completed for Marketing evaluation. Preliminary test results with a four round magazine box indicate that malfunction rates are within the 0.5% goal. 4
- Design of a new bolt action rifle to replace the Model 700 is in progress. Prototype components for a new claw type extractor have been completed for testing in January. 5

CURRENT PRODUCT DEVELOPMENT

- The Model Seven Lightweight rifles sent to Canada for the Writer's Seminar were well accepted. 6
- Trial and Pilot is in progress on the Model 700 BDL in .223 caliber. 7
- Warehousing of the Model 700 Classic in 300 H&H Magnum caliber will begin in June, 1983. 7
- Model 700 ADL Restyle warehousing was begun in November. 7
- Model 870 Ducks Unlimited Trade Shotgun model will be warehoused in December. 8

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● Point of impact test results on the Model 870 Magnum 18" full choke barrel were satisfactory.	8

MATERIALS AND PROCESS DEVELOPMENT

● Injection molding alloy development is progressing well. Stainless steel blends are being tailored to omit thermal binder extraction.	8
● A Research project is circulating to provide funds for a low cost checkering system.	9
● Updated form-rolling economics show a \$365M annual savings and an infinite ROI. An Appropriation Request is circulating for approval.	10
● Additional cryogenically processed powder metal samples have confirmed earlier positive results.	10
● A preliminary layout has been prepared for automating shooting jacks in the Test Lab.	11

STATUS - NEW PRODUCT DEVELOPMENTShotgun Development

New autoloading and slide action 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.

Six (6) functionally different prototype autoloading shotguns have been completed and test fired to a combined total of 43,000 Magnum rounds. These six (6) prototypes were fabricated to provide information on design alternatives for locking, feed, and action systems. Testing is being done to establish endurance levels for these contingency designs. One variation has been selected for further development. Four (4) samples of that version are to be fabricated by February 15, 1983 for design verification.

The projected minimum capital investment required to implement the 12 Gauge autoloading 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. With successful implementation of process modernization programs now in development, that investment can be reduced to less than \$2MM.

The design alternative being considered includes the use of an aluminum receiver. 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 10,000 Magnum rounds with no significant damage to the receiver.

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Six (6) styling samples of the XSG have been assembled for Marketing evaluation. One pump action styling sample will be ready by January 30, 1983. These seven (7) samples depict features that are distinctive and make these guns unique in the market place.

Model 870/1100 Special Shotguns

The Model 1100 Special is being developed to offer the shooter a lighter weight ($7\frac{1}{2}$ lb.), faster pointing M/1100, with a significant change in appearance to supplement the current M/1100 line. Features include a 21" barrel, a slimmed down and shortened fore-end, English stock, cut checkering, medium gloss finish, and no roll marking.

Five (5) 12 Gauge samples and one 20 Gauge sample have been completed for use by the Marketing Department in product displays at various trade shows. Thirty-five (35) prototypes (25 - 12 Ga. and 10 - 20 Ga.) are being fabricated as samples for use by Marketing field personnel. Those guns will be completed by the end of January, 1983.

A design package has been provided to Process Engineering for preliminary tool design. That package is complete except for the stock, fore-end, and magazine cap detent system. Stock formers will be completed in February for both the 12 and 20 Gauge guns. Drawings for gaging will be completed by the end of December. Designs for reinforcement of the fore-end and the magazine cap detent system are in test and will be completed by the end of December. Pending successful completion of those tests and Product Acceptance, Design Transmittal can be completed in February.

Model 7400/7600 Centerfire Rifles

The Model 7400 and 7600 rifles were developed as replacements for the Model 742

and 760 rifles, respectively. They were introduced into the product line in 1981. New calibers and carbine versions are being developed for future introduction to expand this product offering. As those new versions are implemented into production, continued Research support is necessary.

Model guns illustrating design options for the Model 7400 Carbine in .223 caliber are available for Marketing review. Preliminary testing of the four round magazine box indicates that the malfunction rate is within the goal (no greater than 0.5%). In a recent 900 round test, three (3) extraction and two (2) feeding malfunctions were experienced. The primary design questions left to resolve are on the stock, fore-end, barrel, and bolt release. Specifications for the preferred design include a slimmed down Model 7400 stock and fore-end and a lightweight barrel. Pending acceptance of these specifications, design and testing can be completed by mid-February, 1983. Product Acceptance and Design Transmittal could be completed by the end of March.

New Bolt Action Rifle Development

A new bolt action rifle is being developed to replace the Model 700 BDL. This new rifle, to be introduced in November, 1984, will feature new styling and improved function. Styling items include a stock designed by Bob Emmons, an octagonal receiver with integral scope mounts, and a lightweight barrel contour polished without removing the GFM hammer marks. Functional improvements will include a rotary magazine box for more reliable feeding, fully enclosed claw type extractor for added strength, no bind, easy lift bolt for smoother action, receiver with a heavier, integral recoil lug for added

stability, a redundant safety switch, and a fully adjustable fire control that does not require removal from the stock.

Due to priorities being placed on 1983 programs, Preliminary Design completion has been delayed until March. The fourth model gun from Bob Emmons, featuring revisions to the receiver by Pete Grisel, has been delayed until February. That gun will include a tang safety and a Schnabel fore-end. Initial designs have also been completed for the rotary magazine box, the fully enclosed claw type extractor, and receiver with integral recoil lug. Tests of the extractor will begin in January. However, priorities being placed on 1983 programs are delaying fabrication of key components.

STATUS - CURRENT PRODUCT DEVELOPMENT

Model Seven Lightweight Rifle

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

Forty (40) prototypes in 7mm-08 caliber were shipped to Canada in October for use at the Annual Gun Writer's Seminar. Those guns were well accepted by the writers which should result in favorable coverage in future trade magazine articles.

Trial and Pilot of the .308 caliber rifles began in October. The floorplate opened unexpectedly during gallery test. High speed movies showed vibration during shooting was causing the latch to malfunction. The design was revised to change the front latching surface and pin the latch to the latch spring. High speed movies and thorough field testing showed the design change to be satisfactory.

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Trial and Pilot of the .243 caliber rifles started the first week in December with the new production latches. A small percentage of rifles did not have sufficient latch engagement with the floor plate cover. Parts and drawings are being checked to determine the cause of the problem.

Twelve (12) samples each of two new designs for the magazine follower will be delivered the first week of January. New magazine springs to test for improved feeding will be tested at that time.

Barreled actions in .223 caliber are complete and awaiting stocks. This caliber will be introduced in 1984.

Model 700 BDL in .223 Caliber

The .223 Rem. caliber was initially added to the 700 line in the Varmint rifle. Marketing has had requests for it in the standard BDL model.

Trial and Pilot of this caliber has started and guns will be available for Research test in late December.

Model 700 Classic in 300 H&H Magnum

This caliber is being added to the Classic product line on a special one time basis in 1983.

Trial and Pilot has been completed and Research tests were satisfactory. Warehousing will start in June, 1983.

Model 700 ADL Restyle

The Model 700 ADL bolt action rifle has been restyled and introduced at the Gun Writer's Seminar for 1983 production. Revised features include a slimmed down

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stock, satin finish, positive cut checkering, and factory installed sling swivel studs.

Trial and Pilot of 30-06 caliber rifles has been completed and Research test results were satisfactory. Warehousing began in November.

Two (2) new designs of no-bind followers will be received from the vendor in January. Testing with new design springs to improve feeding will be done at that time.

Model 870 Ducks Unlimited Trade Shotgun

1982 is the second year of a program to furnish special shotguns to the Ducks Unlimited Organization.

The Trade Model is a standard production shotgun with special scroll roll-markings on the receiver and a 32" barrel. It is sold through our regular distribution channels with a percentage of the sales price going to Ducks Unlimited.

Trial and Pilot has been completed and Research testing was satisfactory. Warehousing will begin in December.

Model 870 Magnum Full Choke Police Shotgun

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

Point-of-impact (POI) test results on this barrel/choke combination were satisfactory.

STATUS - MATERIALS AND PROCESS DEVELOPMENT

Injection Molding of Metal and Ceramic Components

Injection molding is a technique for producing small, intricately shaped parts

from metal or ceramic powders. It offers a promising compliment to the powder metallurgy process used by the Specialty Products Division, opening up new markets in aerospace, instruments, and medical products.

Excellent mechanical properties have been achieved with a Remington blend of 53% Fe, 29% Ni, and 18% Co, which is an approximation of the commercially available wrought material Kovar. Development of this alloy is in direct response to a request from a potential customer. Parts sintered in a continuous powder metal furnace had an ultimate tensile strength of 80 ksi, with 10% elongation and 95% theoretical density. Additional samples sintered in a Research batch furnace achieved a 98% theoretical density.

Remington stainless steel blends are being tailored for solvent extraction only (omit thermal extraction). In addition to reduced processing costs, this process will eliminate the oxidation potential of thermal extraction. Many of the requests received from Marketing contacts have required stainless steel. Vendor supplied premix alloys have not consistently produced acceptable properties.

Cut Checkering Machine Development

Remington's present N/C cut checkering machines will be burdened 90% in 1983. Additional machines will be required if more product specifications are to be cut checkered, but the cost of adding another machine, similar to what we presently have, is very high — approximately \$700M. The objective of this program is to develop a low cost alternative.

A Research project is circulating in Bridgeport to provide funds for a low cost cut checkering system. If the CNC machine portion of the system can be ordered in January, it should be delivered in time to relieve Production's anticipated over-burdening of existing equipment next summer.

Form-Rolling

Form-rolling is a deformation process, similar to thread rolling, which may be applicable to manufacturing small, solid, cylindrical parts. Initial development work is being done jointly with Rol-Flo Engineering, Inc., West Kingston, Rhode Island. The successful applications of form-rolling to make trigger plate pins, and burnish shotgun firing pins have been demonstrated.

Updated economics show a \$365M annual savings and an infinite return-on-investment. A Research Appropriation Request is circulating to purchase the form-rolling equipment and continue in-house development.

Cryogenic Processing of Powder Metal Parts

Cryogenic processing involves slow cooling of the parts to about -320°F and holding for 24 hours. Significant improvements in properties for wrought parts are claimed. This has been verified for high nickel alloys, where tensile strengths have consistently surpassed 200 ksi.

A fourth set of samples have been processed. This group includes samples that were sintered in vacuum, and in dissociated ammonia. These samples confirmed results of earlier runs. However, samples cooled in liquid nitrogen did not show improvements in mechanical strength.

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Testing and Inspection

Increased emphasis on quality, plus the higher incidence of product liability claims, points toward the desirability of 100% inspection of critical components. Further, the visual and functional inspections of finished products are very labor intensive, and largely subjective in nature. This broad Research program will provide systems to economically inspect critical components, and to automate gallery test and final inspection functions.

A list has been prepared of critical components. This will be reviewed with EPL engineers during the week of January 3. EPL is assisting in selection of equipment for 100% inspection.

A preliminary layout has been prepared for automating shooting jacks in the Test Lab. This is being reviewed with Test Lab supervision.