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RESEARCH AND DEVELOPMENT - FIREARMS
SECOND QUARTER PROGRESS REPORT - 1983
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Remington Arms Company, Inc.

HIGHLIGHTS

NEW PRODUCT DEVELOPMENT

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- Research has approved the Model 1100 Special, LT-20 Trial and Pilot and is evaluating several design alternatives for the 12 Ga. fore-ends. 5
- All drawings for the Model 870 Special have been transmitted and samples for Marketing are being prepared. 6
- Samples and drawings for an estimate on the Model 870 Restyle have been started and will be completed by July 30. 6
- Two (2) Model 111 samples are in test and have been fired to a combined total of 15,000 Magnum rounds. 6
- Drawing work has been initiated on a new design deer barrel for the Model 1100 and Model 870 12 and 20 Ga. guns. 7
- Initial drawings have been received and are being evaluated on a 20 Ga. Parker shotgun. 7
- Model 870 12 Ga. Riot shotgun testing is continuing with no apparent problems. Engineering drawings have been provided to Production for cost estimation. 7
- Marketing and Research have reviewed Model 700 Lightweight prototypes. A model has been selected. Preparation of a transmittal package including new drawings and parts lists has been initiated for a planned August 1, 1983 release to Production. Testing will start July 1, 1983 on 36 prototype .30-06, .270, and .280 caliber rifles. 8
- The Model 7400 .223 carbine project has been discontinued. Model 7400 7mm-08 and .25-06 work and testing has been completed and drawings will be updated for transmittal. The .308 caliber carbine testing has been delayed due to other priorities. 9

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• Prototype XP-100 pistols in .223 caliber will be tested for accuracy in July.	10
• Testing of the Model 870 18 inch full choke, 3 inch chamber police barrel will be complete in July.	10
• Model 700 Classic in .250 Savage transmitted to Production.	10
• Model 700 ADL Restyle stock former work continuing.	10
• Model 870/1100 Waterfowl shotgun delayed to 1985.	10
• Model 870 Limited Edition delayed indefinitely.	10
• Twenty five (25) Model Seven Lightweight rifles with floor plate assemblies made from heavier material were satisfactorily tested.	10
<u>MATERIALS AND PROCESS DEVELOPMENT</u>	
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• Injection molding of Model 700 magazine followers began on June 20.	13
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• A high-strength, wear resistant material has been injection molded and processed to a tensile strength of 200 ksi.	14
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• A low-shrinkage powder metal alloy is being developed to reduce warpage during sinter.	15
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STATUS - NEW PRODUCT DEVELOPMENT

(J. S. Martin)

Model 1100 Special Field Shotgun

(D. S. Findlay, T. P. Powers)

The Model 1100 Special was developed to offer the shooter a lighter weight (7½ lb.), faster pointing Model 1100, with a significant change in appearance to supplement the current Model 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.

Research has completed testing for the LT-20 Specials and has accepted Production's Trial and Pilot. Eleven (11) Trial and Pilot guns were endurance tested. Seven (7) fore-ends were tested to 5,000 rounds. Three (3) were taken to 20,000 rounds. One (1) fore-end cracked at 3,250 rounds at the 10 o'clock position.

Research effort on prevention of cracking in the 12 Ga. Model 1100 Special fore-ends has been concentrated on two primary designs.

Both designs utilize a new detent system retained in the magazine tube. Plastic molds for this system have been ordered. Scheduled date for the design is July 15, 1983. The prototype molds can be used to support Production through the end of this year.

The first design is a buffered fore-end having an elastomer sleeve retained in the fore-end. Sample molded parts are expected by July 3.

The second contingency design utilizes an extension on the magazine cap which separates the fore-end from the inertial loads caused by the barrel. Parts for this system will be ready for test June 22, 1983.

Three (3) back up designs are being worked on:

- Epoxy impregnation of the wood
 - Samples ready for test July 1, 1983
- Black plastic fore-end tip
 - Samples ready for test June 22, 1983
- Double buffer system and a plastic fore-end liner
 - Samples ready for test June 30, 1983

Model 870 Special Field

(D. S. Findlay, F. H. Smith)

The Model 870 Special Field for introduction in 1984 is being developed to complement the Model 1100 Special with the same appearance and performance features (i.e., 21" barrel, slimmed down and shortened fore-end, straight English stock, and cut checkering).

Design acceptance testing has been completed and all drawings have been transmitted to the Plant. Parts for five (5) 12 Ga. Special and five (5) LTWT-20's have been started for Marketing samples and catalog pictures.

Model 870 Restyle

(D. S. Findlay, K. L. Calkins)

The Model 870 Restyle is being developed to replace the current Model 870 in 1985. Specifications include 12 only, 3" chamber only, new fore-end design, matted top and bottom receiver radii, and medium gloss wood finish with cut checkering.

Drawings and samples for test have been initiated and will be completed by July 31. Testing to be completed by August 30.

Model 111 Autoloading Shotgun

(D. S. Findlay, J. L. Kast)

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

The design currently being developed involves the use of a new, patently novel locking system, (rocker arm), improved barrel contour, threaded in stainless steel magazine tube, orifice selector/choke tubes, and improved carrier latch system. Two (2) samples are in test and have been shot 15,000 rounds total. Nine (9) styling samples have been completed which depict options for stock and fore-end design, checkering pattern, and receiver/vent rib contours.

The projected minimum capital investment required to implement the 12 Ga. autoloading design into Production is approximately \$3.5MM. The total included 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

Firearms Modernization programs now in development, that investment can be reduced to less than \$2MM.

A design alternative being considered includes the use of an aluminum receiver which would 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.

Model 870/1100 Deer Barrel

(D. S. Findlay, F. H. Smith)

Introduction in 1985 of a new deer barrel to replace the current offering has been initiated. This redesigned barrel in both models and in both 12 and 20 Ga. will feature a 21" barrel length and a rear sight base capable of mounting a long eye relief scope with a variety of mounts.

Drawings have been started for estimating by Production. Samples will be completed by August 15.

Parker Double Barrel Shotgun

(D. S. Findlay)

Reintroduction of the classic Parker side-by-side double barrel shotgun is being considered. Arrangements are proceeding to complete one (1) VH Grade 12 Gauge Parker by August 1983.

A partial set of drawings from Jesse Briley on a 20 Gauge Parker has been received. These drawings are undergoing engineering evaluation. Once the remaining drawings of the package have been received, they will be sent out for cost estimating by Process Engineering.

Model 870 Police Shotgun

(A. A. Hugick, T. G. Bauman)

By intentionally tripping the feed latch on the Model 870 shotgun, a jam condition can be created which is difficult to clear without removal of the fire control. While no complaints have been received from the field, modifications have been considered which will prevent jamming under the above conditions. Proposed modifications include changes to the slide and carrier assemblies.

Two (2) Model 870 12 Ga. Riot shotguns have been endurance tested to 7,500 rounds and one (1) endurance tested to 5,500 rounds

using 3 inch Magnums and 2-3/4 inch high base ammunition. At the end of each 1,000 rounds, 25 rounds are fired testing the jam condition.

There has been no apparent problems with the anti-jam design feature components and the guns will be continued to 20,000 rounds per gun endurance level. Estimated test completion date is August 1, 1983.

Engineering drawings have been turned over to Production for estimating.

Upon endurance completion and approval, finished model drawings will have to be prepared for Production and then transmitted to Production. Also, a new Model 870 Police gun catalog or supplement will have to be prepared and supplied.

Bolt Action Rifle Development

(F. E. Martin)

Two (2) new rifles are included in the bolt action program, replacements for the Model 700 Classic and BDL, respectively. The replacement for the Classic will be designated the Model 700 Lightweight and is planned for 1985 introduction. While a designation has not yet been determined, the replacement for the BDL is currently scheduled for 1986 introduction. Both rifles will feature a stock designed by Bob Emmons and a lightweight barrel contour. The BDL replacement will include other distinctive styling changes, such as an octagonal receiver with integral scope mounts. Functional improvements to the BDL 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 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.

The replacement rifle for the Model 700 Classic has been accepted by Research and Marketing. Parts list and drawings are being prepared to meet the transmittal date of August 1, 1983. Warehouse date of this rifle is planned for November 1984.

Work on the BDL Replacement will continue on completion of the

above program. Testing of the proposed extractor change is planned to start in September with the completion of the prototypes. Work on the rotary magazine components is continuing. A test schedule will be determined with the completion of the magazine assembly. The magazine rotor, spring retainers, and end plate have been completed. The magazine box is expected by July 20, 1983.

Model 7400/7600 Centerfire Rifles (R. S. Murphy, A. R. Eddy)

The Model 7400 and 7600 rifles were developed as replacements for the Model 742 and 760, respectively, and were introduced in 1981. The Model 7400 .223 carbine was being developed as a sporting version of that popular cartridge to augment this product line.

Due to the cancellation of this project, efforts are being concentrated on collecting all technical data and design specifications and recording this information. For future reference, various prototypes will be completed and assigned to the Research Gun Library. An AI Report will follow.

All preliminary 7mm-08 and .25-06 work (orifice, pressure data) has been completed. A number of rifles in both calibers have been built and test fired satisfactorily. Drawings only would have to be updated for transmittal if this is desired. We are still waiting for a priority to get preliminary measurements on ten (10) standard .308 rifles. This is necessary before work can commence on data confirmation for the carbine length barrel.

One (1) .257 Roberts model has been built and orifice and pressure data is acceptable. This rifle has been field tested with very good results. Barrels are being readied so that additional models can be built to verify our results. Other calibers currently being considered for evaluation are the .250-3000 Savage, 7mm Mauser, and possibly the .35 Remington. Some barrels have been allotted for these calibers and efforts will be made to get orifice and pressure work done.

STATUS - CURRENT PRODUCT DEVELOPMENT

(J. W. Brooks)

Model XP-100 in .223 Caliber

(T. J. Plunkett)

Marketing had requested the addition of this caliber to the XP-100 line in 1984. Testing will be complete in July.

A decision has been made to delay introduction of this caliber beyond 1984.

Model 870 Police Shotgun

(T. J. Plunkett)

Marketing had requested an 18 inch full choke 3 inch chamber barrel be added to the line in 1984. Testing has been completed and was satisfactory.

This gun will be held and added to the line in conjunction with the new modified slide design.

Model 700 Classic in .25 Savage Caliber (P. Nasypany)

The .250 Savage caliber will be a non-catalog item offered on a one-time basis for 1984.

Model drawings and parts list denoting the Rem. 25 caliber 10 inch twist barrel have been transmitted to Production.

Model 870/1100 Waterfowl Shotgun in 12 Ga. (P. Nasypany)

The Waterfowl shotgun will feature a 3" Magnum vent rib barrel and have rust resistant and non-reflective surfaces.

Introduction has been delayed to 1985.

Model 870 Limited Edition

(P. Nasypany)

This special high grade Model 870 12 Ga. shotgun will commemorate the 75th Anniversary of Remington's first slide action shotgun and will feature gold-plated game scenes and high grade wood.

Introduction has been delayed indefinitely.

Model Seven Lightweight Rifle

(D. E. Bullis)

The Model Seven is a short lightweight, bolt action, centerfire rifle developed to replace the Model 600 which was discontinued in 1969.

This rifle is in production in .222, 6mm, and .243 calibers and product is being shipped. During Production start up in 7mm-08 and .308 calibers, the present floor plate assembly opened in Gallery test.

A sensitivity analysis was performed on the floor plate assembly. Using the criteria established, twenty-five (25) rifles were built in .308 caliber. The floor plate base, trigger guard plate, and the floor plate cover were made from heavier material. The present heat treated trigger guard was used. The latch was altered to allow for more engagement with the floor plate cover.

The floor plate pad was altered to allow for the heavier floor plate base. A new latch spring was made from heavier material to give minimum seven (7) pound release force.

Stocks were altered to allow for the thicker floor plate assembly.

The twenty-five (25) rifles were functioned tested for over 600 rounds. Ten (10) of the rifles were then brought up to 1100 rounds. Five (5) of these rifles were brought up to 2100 rounds.

Results of the test indicate satisfactory performance if all specifications identified in the sensitivity analysis were met. Because of the time and expense required to implement these revisions, the decision has been made to proceed with the aluminum casting alternative instead. Our goal is to submit drawings to the casting vendor by July 1 and confirm the design by the last week in July.

STATUS - MATERIALS AND PROCESS DEVELOPMENT

(J. W. Bower)

Process Programs

(J. W. Bower)

Cut Checkering Machine Development

(R. J. Balaska, A. M. Makowski,
E. R. Owens, B. Panagian)

Remington's present N/C cut checkering machines will be completely burdened by the end of 1983. Marketing has identified several new specifications to be cut checkered, requiring the purchase

of additional machines. This machine development program will provide additional checkering capacity at an appreciable reduction in machine cost.

Runoff of a Bostomatic machine, for checkering pressed stocks, is now scheduled for July 18 at the vendors. A fixture for the Model Four stock is being built in the Model Shop, and will be complete prior to machine delivery.

A Requisition has been signed and given to Purchasing for a CO.RE.MA. Model ZZ-A-E checkering machine for sanded wood. Machine delivery is expected 20 weeks after issuance of the Purchase Order.

Testing and Inspection

(J. A. Lawrence, A. M. Makowski,
B. Panagian)

Increased emphasis on quality, plus the higher incidence of product liability claims, points towards 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 automate the gallery and final inspection functions.

EPL has proposed a program to design a rapid, flexible system for inspecting discrete components. Because of the potential use for such a system in their programs, Firearms Modernization will share the cost of EPL's work.

Four-Slide Process Development

(R. H. Smith)

A four-slide, or multi-slide machine is an advanced type of stamping press. TI-121 was approved in April, 1980, to purchase a machine to make Research prototype parts, and dependent on contracts with outside vendors, production parts. The machine was installed in Ilion Research in December, 1981.

Magazine followers for the Models 7400 and 7600 are being processed over the four-slide machine to satisfy Third Quarter Production requirements. A \$10,120 cost savings has been claimed

for using the four-slide versus purchasing from outside. While this cost is still significant, it is down from the originally estimated \$35,000 due to volume reductions with these two models.

Economics have been requested from Industrial Engineering on eight (8) additional components.

Synthetic Shotgun Piston Seal

High temperature plastic piston seals are being investigated for autoloading shotguns. Implementation into the Model 1100 will result in a significant cost advantage, and a reduction in gas system corrosion. Most recent testing has focused on Torlon, a product of Amoco Chemical. Results to date have been unsatisfactory.

Piston seals made from DuPont's Vespel and 3M's Fluorel have been turned over to the Test Lab for evaluation. Also under investigation are DuPont's Kalrez, Delrin ST, and Delrin T.

Materials Programs

(C. Lall)

Injection Molding of Metal and Ceramic Components

Injection molding is a technique for making small, complex, three dimensional components to near-net shape. It has applications for both cost improvements on firearms parts, and commercial sales as an addition to Remington's Specialty Products Division.

- Firearms Components

(B. Panagian, K. C. Rowlands)

Molding of Model 700 magazine followers will begin on June 20. Preliminary Test Lab evaluation is underway. Assembly to production guns is scheduled for August 15, when the Plant returns from vacation shotgun.

A Mold for the common centerfire rear sight slide is due for delivery on July 8.

- Commercial Components

(B. Panagian, K. C. Rowlands)

Preliminary molding and processing of West Co. lyophilization stoppers has shown cracks at the weld line. Mold changes to correct this problem will be made at the same time that shrinkage

allowances are corrected for. Delivery of samples is still expected in August.

• Metal Alloy Development (M. Tasovac, M. J. Topolski)

Preliminary processing of selected alloy systems has indicated excellent prospects for high-strength, wear-resistant materials. Tensile strengths of 200 ksi have been achieved.

Kovar samples have been turned over to Marketing.

Toroids have been made from Fe-3% Si and Fe-50% Ni, and processed according to the Witac procedure. Magnetic properties of the resultant parts were excellent and superior to those of parts processed by powder metallurgy.

• Ceramic Development (M. Tasovac)

An Appropriation Request has been approved to purchase and install a ceramic pilot line.

Several alumina feedstocks have been prepared, and tooth implant samples processed. These will be tested for compatibility with "bioglass".

A very detailed request for quote has been received from Sandia National Labs for processing PZT samples. Because of the many exceptions that must be taken, we will propose supplying parts at no cost.

Testing and Certification of Magnetic Powder Metal Components

(C. Lall)

Pole pieces are used in matrix printers to form a character when an appropriate set of them is energized by a computer. Speed of response, and impact force are very important variables. In order to satisfy ourselves, and the customer, that the part is magnetically correct, a procedure has been set up to measure these variables on an actual part from a production run.

Work is continuing at the Experimental Station to improve the reproducibility of the sintering step in processing magnetic alloys. Additional samples have been pressed, ready for sintering.

Wear Resistant Powder Metal Alloys

(M. Tasovac)

The goal of this program is to make wear-resistant components by the powder metallurgy route. Several approaches are being followed.

A Work Request has been authorized for a project on wear resistant alloys at the Experimental Station. One approach is to consider the effects of "Triballoy" additions to 410 and 316 stainless steels. In addition, 410 stainless and T-15 tool steel will be included in wear-rate measurements.

Development of a High Strength, Low Shrinkage Alloy

(C. Lall)

To overcome the need for a coining step due to warpage at sinter, a low shrinkage alloy is being developed. Samples have been pressed in preparation for sintering.

Scanning Electron Microscope

(C. Lall, M. J. Topolski)

Engineering evaluations of equipment for this approved project are continuing. A Purchase Requisition should be issued by the end of June.