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REMINGTON ARMS COMPANY, INC.
RESEARCH AND DEVELOPMENT - FIREARMS
SECOND QUARTER PROGRESS REPORT - 1982

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HIGHLIGHTS

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● Five of the six XSG prototype shotguns have been completed and are being test fired to document function and endurance. Projected minimum capital investment to implement the XSG design into production has been reduced by 30%.	3
● Model 7400 Research prototypes in 25-06 and 7mm-08 calibers have been function tested. Test results were satisfactory.	4
● Prototype Model Four carbines have been fabricated for review by Marketing personnel, including one lightweight design featuring an aluminum receiver.	4
● Three different prototype bolt action rifles are being fabricated to illustrate design options for replacing the Model 700 BDL. Prototypes are scheduled for completion in September.	4
<u>Current Product Development</u>	
● Model 870 Competition Trap endurance testing has been completed. One gun reached 50,000 rounds with no cracking and one sustained a cracked receiver at 40,000 rounds. Prototype 28" improved modified choke barrels are being sent to Marketing for field tests.	5
● Model 870 trial and pilot 1982 Ducks Unlimited Commemorative and Special Dinner models have been inspected and accepted. Warehousing began in June.	5
● Model 1100 prototype 1983 Ducks Unlimited Commemorative and Trade models have been furnished to Marketing. The Special Dinner model will be delivered to Marketing by June 30.	6

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• A purchase requisition is being prepared to procure etched receiver samples of the Model 870 Limited Edition (1983 Introduction).	7
• A Model 700 ADL Restyle (1983 Introduction) prototype has been completed.	7
• Model 700 Classic .257 Roberts (1982 Special) trial and pilot guns are being tested.	8
• Model 700 Classic .300 H & H Magnum (1983 Special) prototypes are being tested.	8
• Present test results confirm that accuracy of the Model Seven Lightweight 7mm-08 caliber is satisfactory. Other calibers are now being evaluated.	8
• Forty-five rifles are being prepared for the 1982 Remington "Gun Writers" seminar.	9

Materials and Process Development

• The first part of the injection molding process verification has been completed. Research into the use of continuous sintering furnaces looks very promising.	9
• A pilot run of the CO.RE.MA. stock checkering machine has been initiated to determine if acceptable checkering quality can be produced.	10
• Unground Model 870-1100 firing pins will be burnished using form-rolling techniques.	11
• Testing of rim-gated molded Torlon piston seals for Model 1100 shotguns should begin in July.	11
• Laser welded Model 1100 action bar assemblies are at ETL for evaluation. Laser welded and heat treated Model 1100 barrel assemblies are under investigation.	12
• An evaluation is being made of aluminum impacts for rectangular receiver preforms.	12

STATUS - NEW PRODUCT DEVELOPMENT

XSG/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.

Five of six planned XSG prototype shotguns have been completed and test fired to a combined total of 26,000 magnum rounds. Testing will be continued to establish endurance levels for these contingency designs. These six prototypes are being fabricated and tested to provide information on design alternatives for locking, feed, and action systems. Completion of the sixth design has been delayed for approximately one month due to priority on plant support activity.

The projected minimum capital investment required to implement the XSG design into production has been reduced from approximately \$5MM to approximately \$3.5MM by design revisions. Further reduction may be possible, but will require additional testing to document acceptability of the proposed revisions. A model gun is being fabricated for function and endurance testing of the revised designs.

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 6,500 magnum rounds with no significant damage to the receiver.

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.

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. Endurance test results with the aluminum receiver prototype have been satisfactory.

Bolt Action Rifles

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

Three different prototype rifles are being fabricated to illustrate design options including revisions to receiver contour, stock shape, feed system, safety, and fire control. Prototypes are scheduled for completion in September,

including custom stock and receiver designs by Bob Emmons. The third sample from Emmons is scheduled for completion in July and will feature revisions to the stock to facilitate high volume production and modifications to the receiver.

STATUS - CURRENT PRODUCT DEVELOPMENT

Model 870 Competition Trap Shotgun

The Competition Trap Shotgun is a version of the standard Model 870 that has been modified to include a gas operated recoil mechanism. At the 1981 Grand American Trap Shoot small cracks were discovered on some receivers. During subsequent testing it was found that close control of bolt-receiver dimensions and increasing the bolt height eliminated this condition.

Endurance testing of two guns with the new bolt to receiver clearance dimensions has been completed. Testing was continued past the 25,000 round design test, to 50,000 rounds or failure. One gun reached 50,000 rounds satisfactorily. The other gun had a crack in the receiver at 40,000 rounds.

In recent discussions, Marketing indicated an interest in a 28" barrel for use with the Competition Trap Shotgun. (The standard barrel length is 30".) Prototypes of the 28" improved modified choke barrel have been fabricated and pattern tested. Point of impact and pattern percentage test results were within specification. These prototypes will be provided to Marketing for field tests.

Model 870 Ducks Unlimited Shotguns - 1982

1982 will be 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 - 20 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. Revised panel roll mark drawings for the Trade model have been completed. Marketing has requested that one Trade model be completed by August 15, 1982, so that photographs can be taken for the 1983 catalog.

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 V. R. barrel - Commemorative Dinner Gun
- Model 1100 - LT-20 Ltd. - 23" Modified V. R. barrel
(short stock) - Special Dinner Gun
- Model 1100 - 12 Ga. 26" Full V. R. barrel - Trade Gun

Prototype models of the Commemorative and Trade models have been furnished to Marketing. Specifications of the Special Dinner Gun have been received, a model has been completed, and will be furnished to Marketing. Parts lists will be furnished to Process Engineering by June 30 for preparing costs.

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

Model 870 Limited Edition

A special high grade Model 870 shotgun has been proposed to commemorate the 75th anniversary of Remington's first slide action shotgun, the Model 10, introduced in 1907.

Fountain Plating in Springfield, Massachusetts, is supplying etched receivers for the Model Four Limited Edition. They have been provided artwork to quote on samples for the Model 870 Limited Edition receiver. The artwork has been revised to allow for clearance around the ejector rivet in the receiver, as etching may damage the seating of the rivet, and also can cause a color contrast between the rivet and the rest of the receiver. A purchase requisition is being prepared for approval.

Model 700 ADL Restyle

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

A prototype has been assembled with a long action stock having a cheekpiece, slanted fore-end tip, cut checkering on the grip and forearm (side panels only), a slimmer grip area, smooth bolt handle knob, and improved metal finish. Three more long action models (one magnum and one short action) are being made.

Prototype long action no-bind stamped followers have been received. They are being tested with production magazine springs with a dimple, to prevent shifting in the follower. They are being assembled into production guns for Gallery and field function testing.

Model 700 Classic in .257 Roberts Caliber

The .257 Roberts caliber is a non-catalog item offered on a one-time basis for 1982.

Trial and pilot guns are being evaluated by Research. Warehousing is scheduled for July.

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.

Models have been completed and are being tested for accuracy and function. Drawing transmittal is scheduled for July, 1982, with trial and pilot scheduled for October.

Model 700 BDL in .223 Rem. Caliber

The .223 Rem. Caliber was initially brought out as a varmint caliber in the Model 700 BDL. Marketing has requested that it be added to the line in the standard BDL barrel contour.

Models have been completed and are scheduled to be tested for accuracy and function in July. Drawing transmittal is also scheduled for July with trial and pilot in October.

Model Seven Lightweight

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

Accuracy testing of seven actions in 7mm-08 caliber in new Fajen stocks with increased barrel pad height resulted in an overall 3 - 5 shot group accuracy of 1.8 inches. The rest of the calibers in this model are being tested in the above stocks to verify satisfactory accuracy results.

Forty rifles in 7mm-08 caliber, and five in .243 caliber are being built for the Remington "Gun Writers" Seminar in November. They will be ready for testing in September.

Model 700 BDL Left Hand in Short Action

The Model 700 BDL left hand, long action model was added to the line in 1973. Since then, there has been an increasing demand for this model in the short action. Marketing has requested this be added to the line in 1984.

Receivers are being fabricated on production equipment. Ten rifles will be assembled. Five will be in .243 caliber and five in the .22-.250 caliber. These models will be ready in July.

STATUS - MATERIALS AND PROCESS DEVELOPMENT

Injection Molding of Metal and Ceramic Components

Manufacturing parts from near net-shape blanks can provide a significant savings in material and labor cost. Processes such as forgings and investment castings produce blanks that are fairly expensive and still require secondary operations. Conventional powder metallurgy will provide blanks of near net-shape at a reasonable cost, but at a sacrifice in physical properties and surface appearance. Parmatech Corporation has developed a process for injection molding

very fine powders to produce close tolerance parts with near wrought material properties, at a cost between conventional powder metallurgy and investment casting. Remington has obtained a non-exclusive license to use the process to make parts for commercial markets.

Start-up of the pilot-line is proceeding on schedule. The first part of the process verification phase has been completed with Witec 2% and 50% Ni-Fe test bars and a summary report issued. Mechanical testing produced results comparable to what Witec advertizes. Dimensional control, however, was poorer than expected. Tighter molding control will be tried to improve dimensional control.

Parmatech 2% Ni-Fe test bars have been molded. They will be sent to EDL for debinderizing, and returned to Ilion for sintering.

Witec 2% Ni-Fe test bars debinderized and sintered in a continuous Powder Metal furnace came out badly blistered and deformed. However, bars debinderized in Research and sintered in Powder Metal looked very promising. Research will continue.

Cut Checkering

Remington currently cut checkers only its higher grade guns, using press checkering, or no checkering, for the majority of the product line. In contrast to that, most competitive guns, of all grades, are cut checkered. The goal of this program is to develop a cut checkering machine capable of producing acceptable quality at a lower price than our present N/C machines.

A pilot run of 100 Model Four stocks will be made on the CO.RE.MA. machine starting the week of June 21.

Pilot runs at Kurt and Bostomatic are also scheduled for June.

Form-Rolling

Form-rolling is a deformation process, similar to thread rolling, which may be applicable to manufacturing symmetrical, basically cylindrical parts such as firing pins. A preliminary evaluation of five parts, presently produced by other processes, shows a \$280M annual savings, and a 46% R.O.I. 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.

A purchase order has been issued to purchase unground Model 870-1100 firing pins to be subsequently burnished by Rol-Flo. Omitting the grind will reduce the purchase price by at least \$.09 each. At 1981 production rates (approximately 340M) that is equivalent to an annual savings of \$31M.

Torlon Piston Seal

A new stainless steel stamped piston and high temperature plastic piston seal are being investigated for autoloading shotguns. Implementation of this design into the Model 1100 will result in a significant cost advantage, and a reduction in gas system corrosion. Torlon is a high strength plastic made by Amoco.

Amoco has supplied 200 seals molded with a rim-gated mold to try to overcome the inherent weakness of a weld line. Testing should begin in July.

Laser Investigation

Lasers are finding more and more applications in manufacturing. These applications include cutting, welding, heat treating, and inspection. Remington has an on-going program of investigating lasers for the manufacture of firearms.

Model 1100 action bar assemblies, welded by EDL and heat treated in Ilion, have been returned to EDL for testing. Results are due by the end of the month.

Model 1100 barrels and gas cylinders have been sent to Laser, Inc. for welding of the gas cylinder to the barrel, and heat treating of the barrel extension. Testing is scheduled for June 25.

Aluminum Impact Forgings

An impact forging is formed by striking a cold slug of aluminum, held in a die cavity, with a rapidly moving punch. The slug itself is a closely controlled volume of aluminum which is normally cut from bar stock. Upon impact, the aluminum flows plastically through designed orifices between the punch and die to form the part. A finished impact is produced with each stroke of the press.

Quotes for aluminum impact blanks for proposed XSG and Model Four receivers have been received. Conventional machining processes are now being estimated to determine the economics of impact forgings.