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REMINGTON ARMS COMPANY, INC.

RESEARCH AND DEVELOPMENT

FIRST QUARTER PROGRESS REPORT - 1982

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REMINGTON ARMS COMPANY, INC.

RESEARCH AND DEVELOPMENT

FIRST QUARTER PROGRESS REPORT - 1982

Highlights

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• Six different XSG prototype shotguns are scheduled for completion by July 1, 1982 for Marketing review and selection of product specification.	1
• Model 870 Competition Trap Shotguns are being produced with a tighter bolt-receiver clearance and bolts with increased overall height to reduce receiver stress levels.	1
• A walnut master stock for the Bolt Action Carbine has been completed. Initial test results of some calibers with the no-bind stamped follower have been satisfactory.	1
• The .257 Roberts caliber has been added to the Model 700 Classic as a special run for 1982.	2
• A third Model Seven prototype new generation bolt action rifle is being fabricated for Marketing review. Two custom stocks prepared by Bob Emmons for potential use in the new generation bolt action rifle have been completed and reviewed by Marketing.	3
• One side of a Model Four stock has been cut checkered by the CO.RE.MA. machine with a new pattern which requires minimal touch up.	3
• The next production part scheduled for the four slide machine is the M/7400 fore-end reinforcement support.	3
• Amoco will supply 200 diaphragm gated Torlon piston seals by June 1.	4

Highlights

<u>Ammunition</u>	<u>Page</u>
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• The polymer support program instrumented extrusion testing at Pencader correlated some short term wall thickness variations with die pressure changes.	6
• An extended range shotshell program has been proposed which could allow warehousing 65% of required product specifications by year end and production start-up on the remaining specifications in the first quarter 1983.	6
• An information project on extended range center fire ammunition has been written and is circulating for approval.	7
• Primer basics program computer analysis of tests varying primer pellet weight, powder charge weight and temperature indicate that improved shotshell ballistics will result if the primer pellet weight is increased.	7
• The four million round production run of 12 gauge low base promotional product primed with integral anvil battery cup (ABC-202) primers can begin at Lonoke when trial and pilot product passes Technical Services testing.	9
• An experimental run to make 50,000 rounds of 357 Rem. Max. 158 grain SJHP cartridges is being scheduled with assistance from Production.	9

FIREARMS

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.

Review of project economics and performance specifications for the XSG and XPG shotguns has resulted in increased emphasis on contingency designs. Contingencies being considered include the following:

- For improved economics; feed latch system, rear lock system, carrier - carrier latch system, and action spring.
- For improved performance; gas system control and reduced gun weight using aluminum receiver designs.

Six new prototypes featuring the above items are on schedule for completion by July 1, 1982. These prototypes will be reviewed with Marketing for selection of design specifications.

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. Two guns (with these modifications) being endurance tested have reached over 32,000 rounds with no problems. Production is continuing to use the revised specifications and an approved process deviation. A permanent revision to the model drawings will be made pending endurance test results and machine studies of production equipment.

Bolt Action Carbine

The Bolt Action Carbine is a short, lightweight center fire rifle developed to replace the Model 600 which was discontinued in 1979. It will be strategically placed within the Model 700 product line.

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Bolt Action Carbine - Cont'd

An aluminum stock former is scheduled to be completed by Du Pont EDL, on March 26. A contingency plan consisting of a walnut master stock has been completed and delivered to the Plant. This will allow them to proceed with their stock manufacture program.

Prototype stamped no-bind followers have been function tested in 308, 243, and 6mm rifles. Testing is satisfactory. Caliber 7mm-08 rifles are ready for testing with these followers. Prototype stamped no-bind followers for the 222 caliber rifles are due from the vendor the end of March.

Accuracy of the 7mm-08 caliber has not been resolved. The required accuracy specification is 2.7 inches center to center.

- To date both handloads and factory loads have been tested in ten guns with equal results. Three 5-shot groups have given averages of 3 inches; a "bull" or "accuracy" rifle shot 1.7 to 1.3 inches.
- No discrepancy with the SAAMI chamber drawing has been found so far. However, throating angle has not been checked.

Tests are continuing in an effort to resolve this problem.

Model 700 Classic in .257 Roberts Caliber

Marketing plans include non-catalog sales of Model 700 Classics in certain nostalgic calibers on a special order, one time basis for 1982 and 1983. Last year the 7mm-Mausser (7x57) caliber was offered. This year the .257 Roberts will be run, with warehousing to start in June.

The model will have a standard SAAMI .257 Roberts chamber and will be made in the long action to accommodate the longer cartridge lengths used by handloaders.

A pre-pilot quantity of actions has been assembled and gallery tested with satisfactory results.

Transmittal of drawings and parts lists has been completed.

Model 7 Bolt Action Rifles

The objective of the Model 7 program is to design a bolt action rifle to replace the Model 700 family. Major features incorporated into the Model 7 design include an octagonal receiver, "diamond finish" barrel, and a restyled stock.

A second Model 7 prototype bolt action rifle was completed in January 1982. A third prototype will be fabricated and will incorporate a new fire control, integral scope mounts, and a tang safety switch. Other features to enhance the rifle design will be used as they are completed.

Two custom stocks prepared by Bob Emmons for potential use in the new generation rifle have been completed and reviewed by Marketing. A third sample is in progress to incorporate modifications which will facilitate high volume production. The third sample will also include revisions to the receiver and barrel.

Cut Checkering

Remington currently cut checkers only its higher grade guns, using press checkering, or no checkering, for field grade. In contrast to that, most competitive guns, of all grades, are now cut checkered. While Remington's is the highest quality cut checkering available, we are constrained from applying it across the board because of the high cost of our checkering machines. The goal of this program is to develop a cut checkering machine capable of producing acceptable quality at a lower cost.

Modifications to the M/Four stock checkering pattern have been made to accommodate the limitations of the CO.RE.MA. machine. A stock has been checkered on one side with very little touch up required. Various redesign options are now being reviewed to improve the reliability of the machine.

Four-Slide Machine

A four-slide, or multi-slide machine is an advanced type of stamping press. Project TI-121 was approved in April, 1980, to purchase a machine for the manufacture of prototype parts and, dependent on contracts with outside vendors, production parts. The machine was installed in Ilion Research in December, 1981, and production of M/7400 and M/7600 long action magazine followers has started.

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Four Slide Machine - Cont'd

The next production part scheduled for the four-slide is the M/7400 fore-end reinforcement support. Tool design should be complete by June, with production scheduled for December.

A report was issued to the New Products Design group estimating four-slide costs for 18 XSG parts.

Torlon Piston Seal

Stainless steel stamped pistons and high temperature plastic piston seals are being investigated for autoloading shotguns. Implementation of this design into the M/1100 will result in a significant cost advantage, and a reduction in gas system corrosion. Testing of injection molded parts has consistently resulted in premature failure of the seal at the weld line.

Amoco, manufacturer of Torlon, feels that stronger seals can be molded by using a disc or diaphragm gating system. They will supply 200 parts by June 1.

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Ammunition

New Unibody Shotshell Process

The present RXP® shotshell body manufacturing process contains a number of inherent disadvantages which restrict one-piece body production to limited 12 and 20 gauge product specifications. Difficulty in producing straight bodies and extremely tight input slug tolerances are major controlling factors. The new unibody process has been developed to be cost competitive and permit production of quality unibody shotshells in all gauges.

Production of 12 gauge bodies has begun on the Plant prototype machine and one quadrant (3 stations) of the prototype is currently being tooled for 20 gauge production.

An experimental run of 8 gauge bodies was completed on Semi-works equipment. Assemble head and prime feeders, originally designed for the standard two-piece 8 gauge body, have been modified to handle the new unibody. Product is expected to be loaded in March for testing.

Initial 28 gauge bodies from Semi-works demonstrated good performance on first firing, but developed early buckling on reloading. Changes in wall thickness profile are being made.

A large volume 12 gauge body is needed for steel loads and a 1-7/8 ounce heavy magnum. Tests on Semi-works produced bodies have demonstrated reloading performance superior to competitive product currently available.

Preliminary testing of 16 gauge bodies has uncovered deficiencies in cap-to-body integrity and skiving dimensions. Corrective development action is being taken.

Initial tooling for 10 gauge is 75% complete and tool design for .410 bore has started.

The program objective is to have Production tooling available for all gauges by year end.

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Polymer Support Program

The objectives of this program are to eliminate body cut-offs and increase productivity of the extrusion system. Efforts have concentrated on (1) understanding extrusion dynamics to help increase productivity and (2) better filtration in an effort to reduce body cutoffs by permitting higher draw work ratios with minimum visual defects.

A test is currently being conducted on the Research extruder at Bridgeport by ETL and ESD. A similar test had been run in December on a "state of the art" extruder at the Pencader Plant. The main conclusion drawn from the Pencader testing is that short term variation in wall thickness correlates with variations in die pressure. A smaller test was conducted at Lonoke to determine the effectiveness of their gear pump in developing constant die pressure. The gear pump produced very uniform pressures yet wall thickness occasionally varied substantially.

As a result of the die pressure-wall thickness correlation, an experimental pressure control system was installed on a Bridgeport production extruder by ESD. Results to date have been very encouraging but further improvement is required. Other control techniques will be evaluated in the Bridgeport test.

Examination of visual defects (fisheyes) indicate that all are caused by a particle of material which is different from the surrounding material. Examination of Bridgeport product showed that the element silicon was present in 80% of the particles. Examination of Lonoke product determined that their fisheyes were mostly caused by gels. A retest of more current Bridgeport product again showed the frequent occurrence of silicon. The silicon may be introduced into the system perhaps as sand, however, the source has not been located. These particles can be filtered out and filtration experiments will be conducted.

Extended Range Shotshell Program

A Marketing appraisal indicates significant ammunition sales could possibly be lost in 1983 if Remington does not offer a competitive line of plated and buffered shot field shotshells. A Task Force including members of all involved departments was formed to evaluate alternative approaches for introducing this Extended Range line.

The Task Force has recommended an approach which could allow warehousing of product which constitutes 65% of the requirements by year end, with Production start-up of the remaining products in late first quarter of 1983.

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Extended Range Shotshell Program (Cont'd.)

The approach recommended offers optimum machine utilization with minimal disruption to Production, while incorporating state of the art product design. Two machines need to be modified: one Duplex loader to accommodate 3" 12 gauge loads and buffering and sealing, and one Simplex to buffer and seal 20 and 10 gauge magnums.

Several potential technical concerns have been resolved. In preliminary experiments it has been demonstrated that we are able to buffer all involved shot sizes, and to drop harder shot where necessary. In addition, the feasibility of a larger volume 3" 12 gauge body has been demonstrated in Semi-works, although load development work has not been completed.

Product costs are being evaluated and equipment modifications are being reviewed.

Extended Range Center Fire Ammunition

An "Extended Range" concept (increased accuracy, flatter trajectory and higher retained velocity) has been developed for center fire rifle cartridges. This program is designed to appeal to those consumers desiring to upgrade their down range accuracy capabilities and is intended to counter similar actions initiated by the competition. Introduction of eight cartridges with purchased boattail bullets is planned for 1983 followed by an additional 11 cartridges in 1984.

The proposed process for obtaining specified bullet pull involves placing a light cannelure on the Sierra bullet and crimping the mouth of the case into this cannelure. Equipment for doing this in line with the bullet feed and orient operation has been developed. Start-up and debugging of this equipment for the 30 caliber, 7mm and 22 caliber bullets will begin in April. If successful, experimental runs for four cartridges, which have been demonstrated on a performance basis, can be scheduled: 30-06 Spfd. 165, 308 Win. 165, 7mm Rem. Mag. 175 and 223 Rem. 55.

Primer Improvement Program

The objective of this project is primarily to develop a shotshell primer which will equal or surpass competitive primers from a performance standpoint and to develop basic interrelationships between major variables in primer design. This information is necessary to assure that future primer modifications do not create product and process problems and serve as background information for future primer design. Work is being concentrated on ballistic performance, sensitivity, and piercing resistance.

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Primer Improvement Program (Cont'd.)

Analysis of the effect of the primer pellet weight on ballistics performance is continuing. Programs have been developed on the Apple computer which allow mathematical analysis of the interrelationships between primer pellet weight, powder charge weight and temperature. Contour plots of velocity, pressure, time to peak pressure, as well as other parameters have been plotted.

Findings to date for target loads using Hercules 257 powder indicate that increasing the primer pellet weight reduces the effect of temperature on ballistics. There is less velocity and pressure increase hot, and less dropoff cold as the primer pellet weight is increased. Velocity and pressure variation are also less at higher primer pellet weights with the same degree of primer and powder charge weight variations. Time to peak pressure decreases slightly as primer pellet weight increases and is relatively unaffected by powder charge.

The present specification of .95-1.000 gr. average dry primer charge weight is adequate for our current target load using Hercules 257 powder but ballistic performance can be improved if primer pellet weight were increased. An increase in primer charge weight is probably required for good ballistics in magnum loads and perhaps with some reloading powders. The upper limit on primer pellet weight appears to be related to the mechanical integrity of the primer cup/battery cup assembly. Primer cups can be dislodged during firing. This usually shows up first when firing in Model 1100 shotguns with excess head space and oversize chambers. Test results are erratic and may be influenced by cup fit and/or cup material as well as primer pellet weight.

The parameter limiting the amount of primer pellet weight variability that can be tolerated will probably be velocity variation. This is primarily affected by powder and primer charge weight variations. The standard deviation of primer charge weights for both plants has been found to be 0.05 gr. and it appears that powder weight standard deviation is about 0.15 gr. Using these, the calculated resulting velocity variation will be about 40 fps in 25 rounds. This should provide good separation of light and heavy target loads with only slight overlap of the normal distribution tails.

A designed experiment was conducted to determine the effects of cup and anvil hardness on primer sensitivity and piercing. Increased cup hardness reduces sensitivity, however, anvil hardness has only a slight effect on sensitivity. Both cup and anvil hardness affect piercing as perceived by the shooter.

Primer Improvement Program (Cont'd.)

Examination of primers dismantled after firing revealed that all samples of primers pierced to about the same degree. Some leaked more than others and only those that leaked are perceived to have been pierced, in casual observation. A metallurgical change in the brass alone can not be expected to create a primer with an improved balance of sensitivity and piercing performance. Other changes such as anvil fit, steel anvil and cup shape will probably be required and are currently being explored.

Integral Anvil Battery Cup

The objective of this program is to develop an integral anvil battery cup to reduce primer manufacturing costs, improve consistency of primer quality and provide greater opportunity for process automation.

Lonoke PE&C has completed a trial and pilot run of 12 gauge low base promotional shotshells primed with the ABC-202. They made this sample with minimum assistance required of Research and it is now with Technical Services for acceptance testing. If the results are satisfactory, Lonoke will begin production of the four million round sample. The purpose of this run is to establish Production's ability to operate the press and die and obtain experience in assembly of shotshell product containing the ABC component.

Research efforts to modify this component to make it more compatible with the new priming mixture are underway. Efforts at Lonoke will involve increasing flash hole vent area and elimination of a metal fold which has been designated as a stress riser.

357 Remington Maximum 158 Grain SJHP

This cartridge is being developed for introduction with Sturm Ruger's new .357 caliber revolver. The joint goal is to deliver a muzzle velocity of 1700 feet per second from a 10-1/2" long vented barrel at 50,000 psi copper units pressure.

The goal velocity has been achieved using Hercules 2400 powder and a new set of test barrels furnished by Ilion. Design of the vented test barrel was revised to more adequately reflect Ruger's revolver design. The dimension which controls depth of the vent-gap was increased by 88% over conventional 357 Magnum design.

Velocity loss from a solid to vented test barrel was measured as 190 fps with the previous set of barrels. It is now

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357 Remington Maximum 158 Grain SJHP (Cont'd.)

only 100 fps and this improvement was sufficient to achieve desired specifications.

Production has been requested to load 50,000 cartridges. Cases and bullets have already been made. Loncke PE&C has assisted this program by coordinating the work required for packaging trays and tube art work.

WHColeman, II/
CBWorkman: jl
March 31, 1982

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March 1982

RESEARCH PERSONNEL

Remington Roll

	<u>Actual</u> <u>2/28/82</u>	<u>Actual</u> <u>3/31/82</u>	<u>Forecast</u> <u>12/31/82</u>
Exempt	61	60	62
Nonexempt	21	21	20
Wage Roll	23	23	24
	<hr/>	<hr/>	<hr/>
TOTAL	105	104	106

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